

August 1, 1960

Aviation Week and Space Technology

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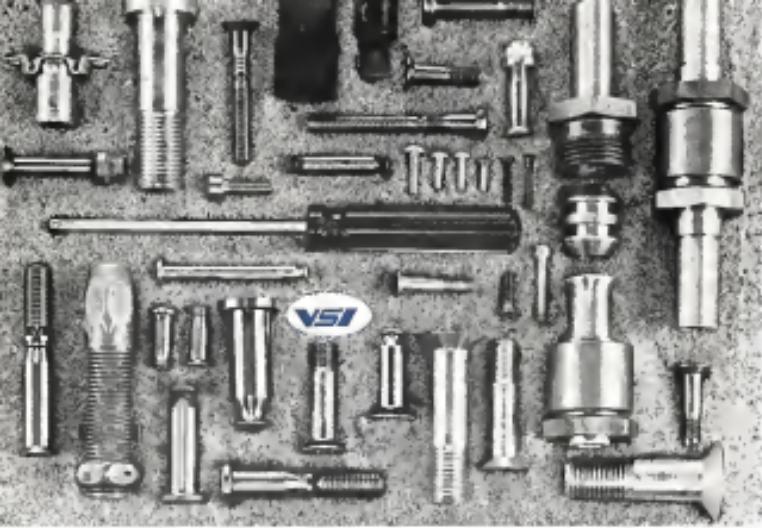
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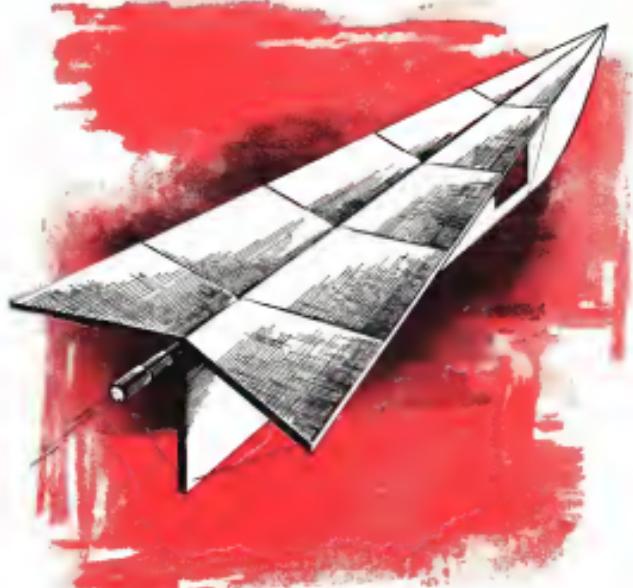
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a message to men who keep a thought ahead of progress . . . Butler and Edwards lacked all but vision when they designed their 19th century delta winged jet. ■ But with today's methods and materials, vision itself is often the only requisite to progress. ■ If your concepts border on reality, perhaps Ta-Cell-O's experience can help turn your parts into skyborne products through our precision-machined parts and assemblies, fuel control devices, servomechanisms, actuators, inertial guidance systems, remarkably precise numerically-controlled machine tools, and other manufacturing capabilities available to you today. ■ Call our Representative, or contact Ta-Cell-O's Aircraft & Missile Division, Detroit.

The use of a semi-fluid pigment, say a mixing mastic analogous to the traditional *colloïde*, was among the advances made in this art as early as 1887, as noted by Eustache Bellot and Edwards in 1887.



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XLB

AVIATION CALENDAR

- Aug. 7-15—Third Annual Institute on Metal and Reactor Technology, University of Connecticut, Storrs, Conn. Co-sponsors: U.S. Army and AFRL.

Aug. 8-11—Western National Meeting, American Nuclear Society, Olympia Hotel, Seattle, Wash.

Aug. 8-13—1986 Faculty General Meeting, American Institute of Electrical Engineers, 81 Clinton Street, San Diego, Calif.

Aug. 14-23—International Conference on Materials and Lubricants, British Hotel, Buffalo N.Y. Sponsors: American Institute of Chemical Engineers, American Society of Mechanical Engineers.

Aug. 18-23—16th Annual Congress, International Association of Fireworks, Royal Hall, London, England.

Sep. 9-11—Fourth Annual International Conference on Biological Effects of Microwave Radiation, New York University Post-Graduate Medical School, NYU Medical Center, N.Y.U. Co-sponsors: American Physical Society, American Physical Society.

Sep. 10-12—Second International Symposium on Substrates and Surface Methods, Laboratory of Aviation and Naval Medicine, Karlsruhe Institute of Technology, Stuttgart, Germany.

Sep. 10-12—1986 Annual Meeting, American Physical Society, Denver.

Sep. 13-15—1986 Congress, Engineering Conference, University of Colorado at Boulder.

Sep. 23-26—Western Electronic Show & Convention, Los Angeles Memorial Sports Arena, Los Angeles, Calif.

Sep. 23-Sept. 5—1986 Auto Rally, Municipal Airport, George M. Spain, Michael Acciari, Ann Arbor, Mich.

Sep. 23—Symposium on Reactor and Seismic Design of Nuclear Power Plants, Institute of Nuclear Energy and Safety, London, England.

Sep. 24—Civitan Club, Clinton Casino, Aspinwall, Pa.

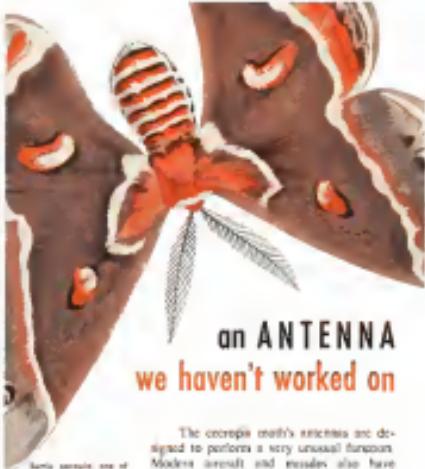
Sep. 5-12—1986 Petroleum Flying Dr.

EQUATION EDITING AND DOCUMENT FORMATTING

August 1, 1949
Vol. 28, No. 5

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GOALS AND TOPICS We usually want to find *the best* solution among many possible ones.

AVIATION CALENDAR

(Continued from page 92)



Raytheon's New Scan Conversion System Provides Memory, Brightness, Alpha-Numerics, Instant Erase

Raytheon's New Scan Conversion System achieves and improves air traffic control with: continuous . . . accurate . . . bright display of all target-in-area information. MEMRAD, the display's two-gas cathode ray tube, stores, converts, and projects radar data on any number of TV monitors. Image is 300 times brighter than conventional PPI. Targets show as continuous trails from which speed, position, direction

may be read or transmitted electronically.

The display also provides instant image erase, and generation of alpha-numeric symbols that lock on and move with target automatically. Masks, subnormal room illumination, all human error related to oral-manual plotting are eliminated. Superimposition of maps, off-centering, large screen TV projection make Raytheon's SCS the vital element in more sophisticated systems.



**EQUIPMENT
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Exercises in Drawing

For Raytheon Sean Conversion Brochure,
Write: Director of Marketing, Equipment Division,
Dept. A1, Raytheon Company, West Newton, Mass.

BENDIX REPORTS ON ITS SUPPORT EXPERIENCE



Bendix mobile computer-tester cuts B-58 flight control system checkout time from 2 days to 90 minutes

DETROIT, MI.—Helping to keep U.S. weapon systems mission-ready is this Bendix computer-on-wheels. It rolls right up to the flight line where, in 90 minutes, it runs through 750 static and dynamic tests on the flight control system of the Boeing B-58 (USAF Convair 880). By comparison, the previous procedure required two days' work by three men just to make static tests. This automatic equipment, although designed for the B-58, can be modified to test any other weapon system.

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BENDIX



Hydraulic and pneumatic calibration equipment, one of the many fields of check-out and support equipment designed and produced by Bendix.



Bendix test stand checks and calibrates fuel control equipment for jet engines

SOUTH BEND, IND.—Bendix fuel control test stands produce operating conditions such as 80°F altitude, fuel flow, temperatures and pressures required for critical testing and calibration of all propulsive control systems—both systems now in use and planned for the future.

The reliability, versatility and ease of operation inherent in the Bendix test equipment springs from a position of knowledge and expertise which is unique in the industry. Since the beginning of the aircraft era, Bendix has served every major aircraft manufacturer and producer of fuel control equipment for all major engine manufacturers. Bendix test stands are now in use at military, airline and commercial installations around the world.

SUPPORT CAPABILITIES EXTEND ACROSS THE BOARD

manual and automatic check-out equipment, adaptive components, environmental chambers, vibration and shock testing and simulation as aerospace systems, training devices and simulators, and monitoring equipment.

Bendix Support Equipment—South Bend—over 30 years' experience and extensive experience to produce hydraulic, pneumatic, and mechanical support equipment. Its operating areas

include land, above ground, and airborne launches; transportation vehicles; and industrial applications. Major erection equipment, handling, hoisting, lifting, and lifting equipment; test equipment and complete test facilities; and hydraulic and pneumatic powerplants. Look at today how this vast array of robust systems experience can help solve your specific support problems.



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The Gyrosyn combines the features of both a directional gyro and a magnetic compass. The difference is in the participating models—which include the C-2, C-4, C-6, C-9, C-10 and C-11—either in size, weight, performance and cost consistent with the application.

The C-2 is the lightest and most compact system available, weighing only 8.6 pounds. The magnetized C-11 incorporates RotoSync® compensation to hold attitude drift within ± 3.5 degrees at least in "free gyro" operation of陀螺仪.

The Gyrosyn combines the features of both a directional gyro and a magnetic compass into widespread use. Gyrosyn systems will be a "must" in meeting critical accuracy requirements.

Sperry has produced and sold more high-accuracy compass systems than all other manufacturers combined.

SPERRY

Weld failures cut 89% using vacuum-melted filler wire

[Weld tests on alloy steel wire used in missile applications revealed nine times as many failures with atmosphere-welded wire as with Cannon-Muskegon vacuum-melted wire.]

Cannon-Muskegon vacuum-induction melting greatly reduces gas levels

(hydrogen less than 25 ppm, oxygen less than 20 ppm, hydrogen less than 5 ppm). Combined sulfur and phosphorus run less than .0005%.]

[These remarkably low gas and impurity levels can be most efficiently obtained with Cannon-Muskegon vacuum-induction melting. You are invited to write Cannon-Muskegon for further details.]

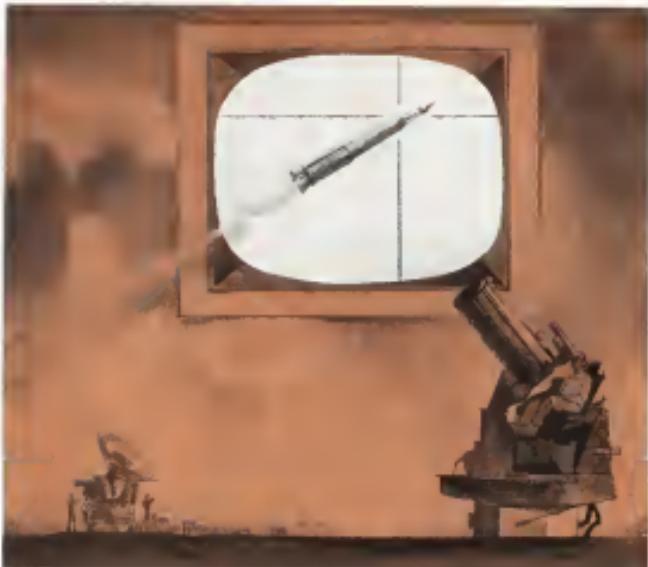
[Among test samples prepared from air-melted wire, 10 out of 22 failed at the weld.]

[Among similar samples prepared from the vacuum-melted wire of the same grade, only two out of 18 were failed at the weld.]

[Different alloys of Cannon-Muskegon vacuum-melted welding wire are available in sizes from 16" to 16", in 30° cut angles, or in 10 or 15.6 mm. sizes packed in straight Argon-filled steel containers.]



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Pursuit by a TV private eye...

The eye on the missile that streaks across the sky is the television camera... part of the Norden TV theodolite, developed in cooperation with ARDC's Air Proving Ground Center, Eglin Air Force Base. This autostatic eye follows the target even with poor contrast between the target and its background of sky.

Once the tracking operator is on target optically his TV camera is also on the target, which it displays on a small monitor. The picture simultaneously appears on a huge TV console receiver. The console

operator sets cursor lines on this screen and the TV theodolite locks on target. From this point, target tracking and data transmission are automatic.

By equipping this tracking equipment with a TV eye and TV screens that mirror the eye's image, by applying engineering skills and experience to development of the TV theodolite, Norden continues to extend man's capabilities.

Stimulating positions are available at all levels of responsibility for qualified engineers and scientists.



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Miniaturized cavity-type filter packs 4.2 square inches of filtering area into 1" x 9/16" element

Parolator develops thumb-nail size element to protect hydraulic control circuits on Army's Hawk Missile mobile launcher.

How small can you make an element that must flow 4 gpm hydrostatic oil at 2000 psi at any temperature within a 215° range? Parolator's new miniaturized cavity-type hydrostatic filter is the best answer to date. Here's why:

An square inch of conventional stainless steel wire cloth can pack one thumb nail filter. This element, which weighs 4.2 square inches (about two millionths per minute of hydrostatic oil), at temperatures ranging from -40° to +215° F. The element will withstand against differential pressures without collapsing.

The element is made up of a total of 10 sheets of stainless steel wire, woven into one cloth and enveloped in etched stainless steel. This element will remove 99% of all particles whose true nuclear diameters are larger than 10 microns, and 100% of all particles measuring 25 microns or more.

The picture at the top of the page shows you the complete filter assembly, ready for installation in the hydraulic control system. The overall length of the unit is 10", maximum overall diameter is 1". Total weight is slightly over 1 pound. Designed as a cavity-type unit, the filter is installed simply by screwing it into the hydraulic system as the filter element intercepts oil flow. The element can be cleaned, cleaned and replaced without special tools.

The picture at right shows the mobile launching platform for the Hawk Missile. The compactness and mobility of the



Launches, and the probability that it would be subjected to severe jolting, made it necessary to specify as small a filter as possible, and one that could be integrated with the rest of the system for maximum simplicity and durability.

The Parolator engineers who developed this new miniaturized cavity-type filter are available now to design a filter to meet your specifications. Simply contact: Parolator Products, Inc., Department 2006, Rahway, New Jersey.

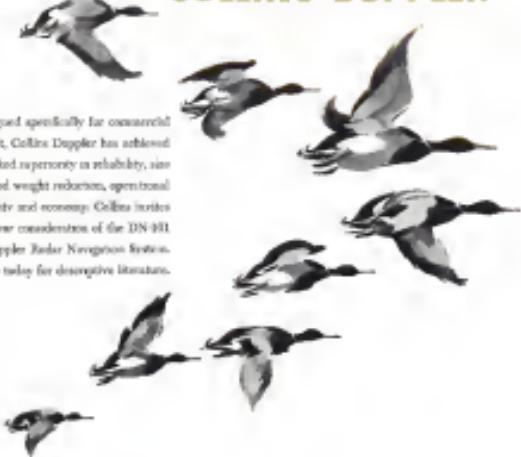
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dead center

Kelsey-Hayes thrust vectoring systems give missiles proper directional control.

Kelsey-Hayes is contributing substantially to the design, development and production of new thrust vector control systems for solid fuel propellants.

For example Kelsey-Hayes, in a recent trade program, designed and fabricated a movable nozzle control that passed static flame tests for one of the newest, sophisticated missile systems.

The movable nozzle control is just one of the latest developments by Kelsey-Hayes in a wide variety of aerospace or propulsion subsystems. Flight compatibility and high performance methods spearheading Kelsey-Hayes activities is the Advanced Design Group, a flexible team of experienced design specialists. Kelsey-Hayes Company, Detroit 32, Michigan.

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Transport problems usually associated with liquid hydrogen have been successfully solved by STANDARD trailers. Some model 2100 trailer tanks have been used for distances more than 3000 miles distant. The illustrated unit has a capacity of 5000 gallons.



Model 2A 1000 trailers have a stainless steel inner tank in combination with an outer shell of light-weight aluminum to provide maximum strength. With a rated capacity of 1000 gallons, they are transporting liquid oxygen, nitrogen and argon in daily service.

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tests duplicate almost any condition of heat, cold, wet, wind, and contamination.

As one of the largest manufacturers of cryogenic trailers, STANDARD pioneered the first all-aluminum transport for liquid oxygen service. Similar units for nitrogen or ammonia use are available using aluminum, stainless or carbon steels.

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EDITORIAL

Defense Is Now a Key Issue

The Nixon-Rockefeller agreement on key planks of the Republican party's 1968 presidential platform has assured national defense a place in the coming election campaign as one of the key issues. The Nixon-Rockefeller agreement resulted in a substantial strengthening of the Republican defense plank (see Congressional Edition Ford Sumner's detailed on-the-spot report from Chicago on page 28) although it did not emerge as strong as Governor Nelson Rockefeller's earlier position on the defense problem. This compromise is the direction of a stronger defense plank at Chicago indicates that the Republicans recognize they cannot stand so truly pat on their record and want take a bush and park approach to the increasingly crucial problems of our national defense posture.

It is now apparent that both political parties are acutely aware that national defense is a burning issue with the American people and that it is a problem that no public office holder can safely ignore in the fall election campaign. In fact, it is a pretty obvious now that the American voter's opinion of how either political party will handle the defense problems facing this country in its historic struggle with the Soviet Union will be an extremely important yardstick in the millions of decisions that will be made in the survey of the voting booth across the country on November 8.

It is a hopeful sign that both parties recognize in their platforms that there is no price ceiling on this country's security and at the same time are in agreement that more money is not necessarily a quick or effective solution but that far more efficient management of our defense resources is urgently required. Both parties also recognize in their platforms that the impact of technology has revolutionized many of our traditional military approaches to the defense problem.

Emphasis on the Future

This provides a good base from which to generate an intelligent discussion of our future defense problems in the fall campaign. It will have little purpose to attempt to pin party labels on our major defense issues of the present period. There have been plenty of other battles. The all-based defense economy was of 1949 by the Truman Administration just before the Korean war began was just about as far off the beaten path as the present Administration's stubborn failure to recognize the growing challenge of Soviet military technology in jet aircraft, ballistic missiles and space technology during the mid-1950s.

Oddly enough, neither presidential candidate has identified himself strongly with the defense issue until recently. Senator Kennedy was unopposed by his

adversary in the great national defense debates of the past few years until he plunged into the missile gap controversy half last fall. Vice President Nixon has several times argued an attempt to take a stronger position on defense issues in the post-Sputnik era but each time has been doggedly held into silence by his superiors.

Candidates' Experience

Both Senator Johnson and Henry Cabot Lodge have had considerably more day-to-day practical experience with the realities of the Soviet threat and methods of combating it than their superior on the party ticket. Senator Johnson in his leadership of the Senate and his work with the preparedness and space committees has taken a leading role in shaping the strong defense policies that have emerged from the Congress during the past few years. Ambassador Lodge in his role as permanent U.S. representative to the United Nations has done an outstanding job in grappling with the Soviets on the multitude of thorny issues that regularly appear before that body. He also played an active role in the Armed Services Committee during his tenure in the Senate. It may be that because of the outstanding backgrounds of both vice presidential candidates in defense problems, the office may play a more important role in this area for the 1968 Administration.

Certainly the defense problems of this period are going to demand a heavy degree of concentration by the chief executive and his principal assistant if any degree of success is to be achieved toward their solution. This concentration will require a more thorough understanding of the modern technology that has revolutionized military science since the end of World War II and more frequent direct contacts with the military leaders who have operational responsibility in such key areas as Strategic Air Command, the joint command oversea or in the direction of research and development efforts. A three-hour trip around Cape Canaveral or a few minutes at the wheel of a nuclear-powered submarine can not be considered adequate training for a chief executive facing the delicate problems of the future.

Both sides of candidates have an excellent opportunity to demonstrate to the voters of this nation that proposed programs and policies on the defense issue. They should provide the voters with the best possible base of comparison on which to make their judgments of which pair would do the better job of steering a sound and courageous course on the defense issue.

This is an encouraging and healthy prospect for the nation.

—Robert Holt

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Upon
Strength...
the
USAF
Ballistic
Missile
Program

The increased strength of the nation depends upon through a constant raising those in the areas of the Air Force fully the Manned Program and related advanced space program. To meet these programs depend upon the continuing flow of men and resources. All of these are added to a common pool of knowledge from which we draw upon for improved capability and know-how, a reducing

in building strength upon strength in the race for space technology leadership, the knowledge and resources gained from Atlas, Thor, and Titan. Effective missile system development is being applied to advance Missions. The three programs, under the management of the Air Force Ballistic Missile Division, Space Technology Laboratories has had the direct responsibility for overall systems engineering and technical direction. As these include missile and related space programs go forward, STL continues to contribute technical leadership and accurate direction.

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BURGOYNE IGNORES RECONNAISSANCE AND INVITES DISASTER

General "Gentleman" John Burgoyne

was not one to favor over reconnaissance. Burgoyne's confused and weakened army, frequently called the turning point of the American Revolution, was the product of a series of "no reconnaissances." British field commanders were not always so supinely confident as to sweep northward from Canada. The British commander rarely knew where or what was ahead. St. Leger's British force, vital element in Burgoyne's campaign, disintegrated when its humble Indian contingent worded at news of a huge American counter force. Reconnaissance would have readily shown the Americans masked a mere 1,000 men. Along his march, Burgoyne dispatched his grenadiers to reinforce a Hessian advance and Bennington—as usual, without adequate reconnaissance. The grenadiers did not discover until after they were decimated by a Colonial force that the Hessians had already been wiped out. Finally,

Burgoyne's confused and weakened army, seemingly surrendered at Saratoga.

Throughout history of warfare, successful field commanders have based command decisions on proper reconnaissance. Burgoyne ignored history and the elements used for strategic and tactical reconnaissance thus causing a series of fateful erroneous decisions and helping to ensure the success of the American Revolution.

From the beginning of communications on the face of the earth, reconnaissance has helped shape history. Today CAA's normally in this area is helping shape history in the advancement of the first World. Typical of CAA contributions are: VHF, Visual Integrated Personnel Data Display system; KA-10 the world's most reliable electronic scanner; SODIS the only electric optical "available now" guidance system.

WHO'S WHERE

In the Front Office

George Kenney, a director Douglas Aircraft Company, Inc., Santa Monica, Calif. Mr. Kenney is president of American Motors Corp.

Frank P. DeLoach, Jr., president, Aerotronics Associates, Inc., Los Angeles, Calif., succeeded Robert L. Radt, now board chair man.

Melvin P. Sperry, a director and vice president-ex-president, Perkin & Farnsworth, Mass.

George H. Myrick, a director, Northrop Systems Corp., Los Angeles, Calif. Mr. Myrick is a director of George Corp., a subsidiary of Lockheed Corp.

Joe Kamm, president, Federal Industries Corp., South Portland, Me.

Orville L. Jones, former Washington representative to Model Engineering and Manufacturing Co., Inc., has joined the staff of president Arthur Deacon, Mr. William G. Stephen, vice president/marketing.

Richard H. Hornerius, formerly vice president-financial division of Douglas Aircraft Co. (AW Job 211 p. 31) continues our president of the new division, Grumman Co., Scottsdale, Calif.

Edie Jester and Raymond J. Stepanek, directors, Space Corp., Denver, Tex. Mr. Jester is the company's vice president-marketing, Mr. Stepanek, vice president-manufacturing.

George D. Roth, a vice president, La Research Resources Co., Philadelphia, Pa. Mr. Roth continues as director of marketing.

E. C. Chapman, president and general manager, Control Engineering & Research Co., El Monte, Calif.

James B. Fischer, Executive Vice-Chair, U.S. Patent Office, Department of Commerce.

Albert J. Woodhead, III, vice president and general manager, Space Industries Corp., The Woodlands, Tex. Cleveland.

James R. Bell, vice president and general manager, Bell Electronics Inc., Long Island City, N.Y., a Bell Com subsidiary.

Frederick W. Dunn, manager of the press and public relations, Hughes Aircraft Co., Los Angeles, Calif.

George Cleman, director of the Space Div., Santa Monica, Calif. Col. John R. McElroy, chief of Air Materiel Command's Lot 1 Division (AMC-L1), Procurement Division, Col. Robert E. Lee replaces Col. McElroy as chief of the Logistics Logistic Division at AMC Headquarter.

William E. Golos, general counsel and John H. Wexler, patent counsel, National Research & Supply Administration's Marshall Space Flight Center, Huntsville, Ala.

Honors and Elections

Dr. Otto Staben, distinguished scientist and consultant to the U.S. Army's Long Range Radar Laboratory, has received the Distinguished Public Service Award from the Department of Defense. "For exceptionally meritorious contributions to the security of the United States."

[Continued on page 96]

INDUSTRY OBSERVER

► Soviet scientists are working intensively on communications satellites, with primary emphasis on telecommunications (telephone) paths costing \$17,000 per equivalent orbit. Soviets plan to use a "directive reflector" to provide higher gain and power output than maximum that NASA's sophisticated passive satellite would. Soviet reflector may consist of a web or set of dipole reflectors, oriented to catch signals from earth.

► Solid and underground control centers for first three generations of Minuteman missiles will be connected by cables, but successive installations probably will use "steerable" earth return cables. (AW Job 18, 1958, p. 26.) Wind installation for three squadrons costs approximately \$10 million for cables and \$20 million for turbines and earth.

► Nimbus 1 weather satellite's sophisticated sensory system will include a system return providing almost complete coverage of the globe, electrostatic tape subsystem to provide higher resolution studies of hurricanes, etc., triple infrared subsystem with 5 mm high resolution sensors for night cloud cover, 30 nm medium resolution sensor for radiation measurements, and 300 nm, low resolution heatbalance studies. It also will measure the solar constant and solar ultraviolet and particle radiation. Launch is expected later next year.

► Selection of a contractor for the GRK test set adapter for the USAF-Douglas Starburst launchable ballistic missile is imminent. Motorola and Pickard-Bell appear to be favored among the 19 from that selected bid to Northrop's Northstar Division, subcontractor to Douglas for guidance.

► Orbital radio reflector consisting of thousands of fine metal needles in hexagonal shapes by Massachusetts Institute of Technology, under Defense Department sponsorship. Needles would fly out to provide an extremely large efficient reflecting surface. They would be designed to permit no collision hazard and no interference for radio altimeters or space radio experiments. Trials are expected within a year in a "piggyback" payload.

► USAF has been asked to submit a program for development of a satellite search-and-rescue vehicle, including experimental launches, to Defense Department. Goal is to develop close approach techniques. These design for superior attitude control, television, infrared cameras and/or nuclear radiation detectors, as low-orbit satellites with kill capability, should be relatively early, Defense believes. USAF has pushed the idea under the Small Satellite Inspection and Interruption project.

► Limitful procurement of Nike Zeus anti-ICBM missiles for point defense of a few strategic sites is gaining increased support in Defense Department. Goal is to develop close approach techniques. These design for superior attitude control, television, infrared cameras and/or nuclear radiation detectors, as low-orbit satellites with kill capability, should be relatively early, Defense believes. USAF has pushed the idea under the Small Satellite Inspection and Interruption project.

► Possible military hazard posed by re-entry into the atmosphere of a satellite missile from a satellite's power system will be investigated by Avco under a contract with Wright Air Development Division. Avco hopes to develop techniques for monitoring conditions of such a reentry.

► Defense Department studies for implementation of USAF's program for small, mobile ICBMs (AW Job 18, p. 36) will depend on "feed-back" control systems to prevent loss by carry-away from spin of thousands of track interceptors-launched. Second phase of the study, which customizes spin operation of radars launched in 1970, is expected to receive more serious consideration than early phase, which would have missile study in 1963, conflicting with Minuteman's availability.

► Image enhancement equipment being developed for Army by FMA, Inc., for identification of mine fields is proposed for use in space to identify and interpret, by direct scope viewing, physical phenomena normally undetectable on photographic or video display. System, expected to have a 2,000-line resolution capability, should give better definition and speed the examination process.

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Washington Roundup

The Defense Issue

The importance of defense as an election issue since was obvious last week in Republican picketing over the platform. Franklin Roosevelt's defense record seems to run on. He got a plainer, more liberal enough to give firms considerable leeway during the campaign.

The only major proposal to come from the Republicans was to increase the defense budget when a new Administration takes over in January. Both Democrats and Republicans are now in need for a bigger effort although the Democrats take a stronger stand.

Roosevelt's long war record adopting the defense philosophy of New York Governor Nelson Rockefeller, which is very similar to the Democratic position. Gov. Rockefeller's plan called to treat the defense plank down the road, but it enough suggests a change in the magnitude of the defense effort. Apparently Nixon sensed a strong public interest in the issue and didn't want to be tied to a potentially unpopular stand.

President Eisenhower approved the defense plank in the Republican platform, but he made it clear he still stands as his record. He told the convention there is room for program changes to meet changing conditions, but basically he concentrated on defending the defense policies he has followed during his years in the White House.

The Defense Department submitted a progress report on the Project Defender ballistic missile defense system last week. That Advanced Research Projects Agency research program has produced considerable new knowledge on the radar and related radiation signatures of ballistic missiles. This kind of data is fundamental to increased missile detection and defense programs.

New information is valuable, but nothing verging on a technological breakthrough in ICBM defense concepts.

Mail Airlift Threat

Potomac Council Arthur Stearnsfield called airline officials in Chicago last week for a conference on the Compton Bill. This legislation would prohibit flights of arm and not carrying or armed stamp. The House approved it, but it is expected to hit rough sailing in the Senate.

Stearnsfield outlined adverse effects by the unions that went into putting the bill through the House and described pressures the rail carriers are applying in the Senate. It was apparent that railroads would have to exert a counterpressure in the Senate through the American Association of Railroads.

Stearnsfield also told the airways that the Post Office Department is willing to accept Civil Aeronautics Board rates for airmail and airlift. He said the Post Office is not pushing for airmails to negotiate rates with individual carriers.

Negotiations on a nuclear test ban took a small step forward last week when the Soviet Union offered to permit three inspections a year in its territory. These inspections would be made by international teams investigating possible violations of a nuclear test ban.

This inspection provision is two fold in its acceptance by the U.S. and Britain. But it is accepted as a sign of Soviet intent in serious negotiations after dodging the issue of definite inspection quota since April, 1958.

Study of Aerospace

House Government Military Operations Subcommittee is studying the organization and role of Aerospace Corp. Last year this group, headed by Rep. Cliff Hollingshead, objected to Sperry Technology Laboratories Inc. with Thompson-Kane Worldwide. Their objection led to replacement of SLL by Aerospace Corp. in Air Force Ballistic Missile Division's technical work.

Cold war tensions were evident in reports of Government buildings around Berlin and over U.S. bases in Spain. Both White House and State Department denied rumors that the U.S. had intelligence reports warning of a significant increase in Soviet military strength around Berlin and of plans to move against West Berlin within 30 days.

Air Force denied a report that Cessna's Model B-15 in transport transports flying to Germany to Coblenz were being used from U.S. bases in Spain and U.S. intercep-tor Czech transports reported to have swooped down from purchased sources several times in attempts to fly over U.S. bases in Spain and Morocco.

Strategic value of the growing Soviet fleet of longrange surface transports was demonstrated when three B-15s flew 6,000 mi. to the Congo, each carrying close to one ton of food. The B-15s also carried German troops to the Congo to join the United Nations force.

—Washington Staff

AMC Plans ICBM Site Activation Force

Twelve regional commanders will be assigned to speed Atlas, Titan bases toward operational status.

Washington—Moving fast to implement its new responsibility in the ballistic missile program, Air Materiel Command will designate 12 senior Air Force colonels as site activation task force commanders at the various Atlas and Titan deployment locations under construction across the country, to soon out-distract and maximize speed in all phases of effort toward operational capability.

The task force commanders will report directly to Maj. Gen. Thomas F. Gandy, new commander of AMC's Ballistic Missile Center, Ingleside, Calif. With his new assignment comes a week end. Gen. Gandy has briefed AMC on the projected detailed status AMC will take in its new responsibility.

Management responsibility for this ballistic missile site activation job was delegated to AMC after eight months of review, reevaluation and deliberations by a team of about a dozen recent officers from Research and Development Command, Air Materiel Command and Headquarters USAF, and the chairman of the Aerospace Board. Headlined by Gen. Edward S. Andrew, AFMDC commander, the lead colonel that entire spectrum of program management for existing ballistic missiles, and considered a "pioneer" for management of future weapon system programs.

Conclusions of the board, followed by deliberation by Headquarters USAF, and subsequent endorsement by Air Force Secretary Defense C. Sharp, resulted in separation of ballistic missile development and site activation into separate organizations. On July 1, 1979, AFMDC became responsible for the development of the missile acquisition, status responsibilities for site construction, design, configuration control and technical engineering, and for technical demonstration of the weapon system's operational capability. There ended, continued control of the ICBM bases from work acceptance to point of forming the site activation task force. The AFMDC task force is to be headed by Lt. Gen. George W. Moore, AFMDC's Ballistic Missile Division, with AMC's Ballistic Missile Center contributing in a supportive capacity. Now, from the point of time beginning since the site has been selected and announced by AFMDC, the readying job is AMDC's. This will include such site activation factors as construction, modifications and check-out of the sites, including construction incorporated into the sites in part of the ground support.

Under that approach, AMDC will be responsible for those factors to be considered, re-evaluating those support agreements, and will have joint accountability for contractors' direction and performance. The AMC base site commanders will have administration over all

Ballistic missile program objectives feel that this new construction effort will have to be delegated specific director authority, as distinguished from a more coexisting relationship, with respect to Corps of Engineers' other field offices which have been involved with initial implementation of construction phases of the ICBM sites. But if that is not possible, those commanders would be responsible for those problems, a recognition of the fact that occurs in the joint task force. Apparently the question was being given serious consideration at a Corps of Engineers general staff level meeting in Washington last week.

Some Ingleside missile program observers have suggested that joint service fraction and recall for authority have been less responsible for the switch in site activation responsibility from AFMDC to AMC, with the lead decision being made in AFMDC's favor by USAF Headquarters. But it is believed that the AFMDC argument was predicated on the fact that not so much the change in authority, after a several rotation, after reevaluation, of what is considered a basic AFMDC function. Possibility of that the decisions for changes might have been accelerated by the delays in meeting hard lead program schedules, attributed to be less than one month late, in the most recent instance, at Offutt AFB, Neb., and less than that at Vandenberg AFB, Calif. This is another factor in the transfer of site activation authority to AFMDC.

Site activation management responsibilities as originally delegated to AFMDC at the start of the ballistic missile program was not considered unusual even at the time of the original base transfers of the early 1960s. No possible exception was available then for this type of coordination, with all of the ramifications of added increased manpower. Certainly no Air Force site lead project had ever involved such work magnitude and complexity. Now that base construction sites of interest have moved ahead, along with work on the missile project, military observers feel that delegation of site activation responsibility to AFMDC is a natural progression in management of efforts to attain timely management of the facilities of both AFMDC and AFMDC. Early indications of the tempo of responsibilities to AFMDC, and field office operations were visited in discussions from both AFMDC and BMD, with manpower able assigned along along as to can in favor

of AFMDC's personnel regardless of the command in which they are assigned. Associate plane confirmation in the Atlas and Titan programs will have technical representatives at the respective sites to assist AFMDC in its activation role.

Corresponding with the new deployment site activation responsibilities, the U.S. Army's Corps of Engineers has set up a new integrated ballistic missile construction office, led by Gen. Alan C. Weilberg, in the Air Force's ballistic missile complex in Ingleside, Calif., to expedite site construction. This new office will encompass the Corps of Engineers present field office in Los Angeles with 30 soldiers and civilian employees. Initial strength of the site construction office will be 25 soldiers and 115 civilians, according to AFMDC. The Corps of Engineers has reported to missile sites on numerous duty days to be followed shortly by 40 more officers who will be transferred from lesser priority assignments to key jobs at missile construction sites.

Contractor Conference

Washington-D. & Defense Secretary Thomas S. Gates Jr. called the two sets of 49 contractors in the Atlas, Titan and Minuteman programs to Washington this last week in an effort to keep these ballistic missile programs on track.

Discussions were to emphasize construction, modification and checkout of equipment. The meeting was out of a series of Defense Department moves to tighten the type of progress checks which have put Atlas bases as much as five months behind schedule.

Attending the meeting were the top executives of 16 missile system contractors and 32 construction, maintenance and engineering contractors. AFL-CIO President George Meany was invited to represent labor organizations.

AMC Site Commanders

The 12 new task force commanders appointed by AMDC in its initial step is taking over ICBM site activation responsibilities Ingleside.

Maj. Gen. Thomas F. Gandy, AFMDC, AFMDC AFB, Wash.-Col. Robert E. Johnson, AFMDC, Walker AFB, N. M.-Col. Robert F. Bannister, AFMDC, Fisher AFB, Fla.-Col. William E. Rausch, AFMDC, Schelling AFB, Fla.-Col. Arthur W. Crouse, AFMDC, Offutt AFB, Neb.-Col. Ernest L. Roemer, AFMDC, Elmendorf AFB, Alaska-Col. Hugh H. Vane, AFMDC, Portland AFB, Ore.-Col. Colville W. Fife.

Titan Sites:

Loring AFB, Maine-Col. Edward J. York.

Barksdale AFB, La.-Col. William E. Smith.

Ellsworth AFB, S. D.-Col. Kenneth W. Norcross.

Mountain Home AFB, Idaho-Col. William E. Brown.

Lowry AFB, Colo.-Col. James H. Thompson.

at AMDC. Types of AMDC personnel involved included plant representatives representing the U.S. Space Service, the Air Materiel Area (the cognate AFMDC), Ballistic Missile Center personnel and others.

Some of the items which have contributed to the delay in ICBM base program include:

- **Conceptual concept.** Base philosophy of developing all elements of the ICBM system at once, rather than the second generation, 1,000-mi range AFMDC ballistic missile is ready early in 1982. Although the Polaris program is substantially finished now, the Navy feels this stance should be utilized for conceptual research and development of the AFMDC base. Williams, P. Tolson, Polaris program chief, told the Aerospace Rocket Society, last week that AFMDC was funded now, it would be ready for flight use in 1984. Tolson said AFMDC would give Polaris engineers an effective lead in the area of new solid-strap joints, triple the size possible with the 1,500-mi version.

- **Equipment deficiencies.** Delays in ground support equipment, to be expected in any development program late apparently. Fault diagnosis and retrofit to remedy the conditions has not always been available.

- **Experiments.** New standards of quality control in concepts and test construction have introduced difficulties in some instances. The coating techniques im-

plied by ICBM weapon system requirements have introduced rapid separations involving uncontrolled tech rates.

- **Weak storage.** This has been an item of the inter-force liaison regularly contemplated in the program. First example of a major upgrading condition in the inter state, which totalled over 100 days, and affected equipment delivery as well as construction schedules. Some equipment normally can sit in the ground support categories actually in the field, but the lack of storage as the proposed holding facilities for the models, which would be delivered through a shortage of material.

- **Lack of direct control by AFMDC.** AFMDC Division in the construction phase of the base sites. In some instances, BMD did recommend certain improvements to the Corps of Engineers, but no prior contracts were executed as a result of recommendations.

Navy Asks Evolution Of 2,500 mi. Polaris

Washington—Navy will pass down two major fronts next year. Polaris conversion to push development of the 2,500-mi AFMDC upgrade.

Pent. Polaris submarine branch (AWM July 25, p. 12) stimulated legislative committee at both Democratic and Republican congressional and Navy be before the entire Polaris program will be re-examined during the congressional session this month.

The AFMDC investigation find that AFMDC has a 1,200-mi range, and will be the first intercontinental version. Navy conversion to intercontinental will be the second generation, 1,000-mi range AFMDC ballistic missile is ready early in 1982. Although the Polaris program is substantially finished now, the Navy feels this stance should be utilized for conceptual research and development of the AFMDC base. Williams, P. Tolson, Polaris program chief, told the Aerospace Rocket Society, last week that AFMDC was funded now, it would be ready for flight use in 1984. Tolson said AFMDC would give Polaris engineers an effective lead in the area of new solid-strap joints, triple the size possible with the 1,500-mi version.

An AFMDC Polaris to 1,500-mi range will result from adding fuel to the first stage engine, which will be enough to lengthen the length of the vehicle from 28 to approximately 31 ft. Longer stages will result from general mass reduction, namely weight decreases and higher specific impulse in the two solid fuel engines.

• **Experiments.** New standards of quality control in concepts and test construction have introduced difficulties in some instances. The coating techniques im-

this year. Aircraft and the AF communications release total energy of more than five million pound/second tech rates.

Since the submarine Polaris launches, the Navy has awarded contracts totaling \$125.5 million for program components. Electric Boat Division of General Dynamics Corp. won a \$60.1 mil. contract to build two fleet ballistic missile submarines, and Newport News Shipbuilding and Dry Dock Co. was given a \$51.7 million contract for two submarine Northern Northwest Division. The third submarine contract for DART/MOD chartered version (AWM July 25, p. 12) is expected, perhaps later this month.

At the missile review, naval operational status North Atlantic Treaty Organization nations are continuing consideration of the U.S. proposal that they adopt Polaris as a medium submarine program.

Friendly liaison apparently is cool because President Charles de Gaulle prefers to maintain in France the traditional capabilities to develop complete weapons systems. France has established a \$1.1 billion, long-term program to develop nuclear weapons and delivery systems (AWM July 25, p. 14).

Titan II Propellant System Briefing Set

An Air Force Ballistic Missile Division will hold a flight briefing for replacement AFMDC in Ingleside, Calif., on a new propellant system for components of the Titan II propulsion transfer system.

As dictated by BMD, the Titan II propellant transfer system consists of mobile loading and unloading equipment propellant tanks that connect to the missile, and ground fueling equipment to move liquid oxygen and liquid hydrogen into the propellant tanks.

The system will be designed to handle the new reusable propellant—a mixture of hydrogen and cryogenic diethylidodecyl boronate fuel and nitramite ester. The Titan II propellant transfer system will be used in the Titan II.

An Air Force will subject all critical propellant transfer system components to prequalification tests. At the moment, work is still under way on identifying the critical components in the following categories: valves, filters and strainers, pumps and motors, load cell platforms, and instrumentation.

On Aug. 9, the Air Force will test these components for potential replace-

Republicans Pledge New Defense Efforts

By Fred Entriken

Change-Republicans reaffirmed their defense platform at the urging of New York Governor Nelson A. Rockefeller during the national convention last week, pledging new defense efforts but shifting to avoid as much ascent and continue administration policies in science and technology and transportation.

This is how the GOP stands in these areas:

• **National Defense**-It is the revised national defense plan, the GOP recognized the need to reexamine defense taking place and pledged "strategic and economic" defense efforts and promised to provide any amount to ensure expenditures to meet our obligations.

• **Science and Technology**-Despite admissions that Russia leads the U.S. in big business, the Republican platform said as an overall science and technology, the U.S. has not had well enough to lead the world. At the same time, however, the Republican panel said it will need to strengthen basic and applied research programs and prioritized continued government support

in projects of national significance.

• Transportation-Symptom of the only refinement to the transportation, Republican pledge—"increased improvement of our vital transportation network, moving forward rapidly the vast Eisenhower Nation national highway program and promoting safe, efficient, competitive and integrated transport by air, road, rail and water under responsible, sound and rational regulation directed in these ends."

Defense Plan

In the platform conclusion, neither the defense plan had been on record. Republicans said "we believe that we set, so far as can see through the obscurity of time and trouble, the proper cause for the nation in its form of trial."

"Secret Union has entered another of the new situations of peril," the platform said, "which has been the continuous assault from the beginning and will continue to be until our strategy is changed."

"The speed of technological change makes it imperative that we assume the new situation by their special resources and accelerate as appropriate our

efforts in every direction, economic and military, to be able to deal with this."

"As rapidly as we perfect the new generation of weapons," the platform said, "we must use them effectively and without delay. In this regard the nation stands as one of the new points of departure. We must enter fully into technology, particularly in nuclear and propulsion fields, to lag for no reason and with time at our least dependable and poorest upgradings of equipment and supplies."

The defense platform, which on a large part follows the Rockefeller-Nixon agreement reached in New York earlier, said that under the Eisenhower-Nixon Administration, the country's military strength has been "brought into a power second to none" and pledged the U.S. will continue to have the defense needed to protect freedom.

In the moral platform this language was added: "Small technological change and the warning signs of Soviet aggression make clear that extended and strengthened efforts are necessary for the development of the 1950s will of course demand new efforts on the part of our entire nation."

No Price Ceiling

The Republican platform said "there is no price ceiling on America's security." The United States can and must pursue whatever is necessary to protect its own security and that of the free world, and this was added in the resolution: whatever is necessary to ensure maximum opportunities to meet new situations."

Strategic importance of the national defense program, Republicans said, are these:

• "A nuclear-strike capability, that is, a nuclear retaliatory power that can inflict surprise attack, strike back, and defend our possible enemy."

• "Highly mobile, versatile forces, well-trained, well-deployed, to deliver in short time agreements and break fire fast," which might bring an efficient nuclear war.

• "National determination to capture all necessary military capabilities so as to render any level of aggression impossible. Definition of war was made specifically, has been the credit of our firm statement that we will never again permit a potential aggressor to set the general rules for his aggression; that we will respond to aggression with all the force, means and weapons necessary to the situation."

Macmillan said this interpretation requires the following actions: the GOP platform stand:

• "Unnecessarily modernization of our

military forces, continued development of the armed forces will end the missile age, with secretary members of these branches protected through dispersal and interchange sites."

• "Development and production of new strategic missiles, the following was added to the original draft: 'such as the Polaris submarine and ballistic missile. Never will they be neglected as intercontinental missile development was neglected between the end of World War II and 1953.'

• "Assurance is necessary, development of freedom, mobility, dispersal and production programs for long-range missiles and speedy perfection of new and improved processes of missile and communications systems. (The phrase "assurance is necessary" and "and production" were added to the original draft.)"

• "Identified development of space civil defense to enable our people to protect themselves against the deadly effects of atomic attack, particularly fallout, and to develop a new program to build a system of shielded food, adequate to the needs of the population in case of atomic attack."

• "Continued intelligence operations, including Communist military preparations, to prevent another East Berlin."

• "A military retaliatory capability is added with a revised strategy which enables the unified commands in Europe, the Pacific and Asia to continue to respond promptly to any kind of aggression."

• "Strengthening of the military might of the free world nations in such ways as to encourage them to assume among responsibility for regional security."

• "Continuation of the 'long-haul' predominant policy which, as originated under the Eisenhower-Nixon Administration, has avoided the pernicious politics and shyness of defense spending and shyness of defense spending and gloom which marked earlier Administrations."

New York Meeting

After the New York meeting between Governor Rockefeller and Vice President Nixon before the convention started, the two agreed that no nuclear weapons should be continued with all the rigor and funds needed to maximize the strength of our alliance of levels essential to our common safety. The firm diplomacy of the Eisenhower-Nixon Administration has been supported by a military power superior in size in the history of our nation or in the world. As long as world tensions increase in this way, we are resolved to maintain as strong a position as can be by our

• "We believe the United Nations will be effective in the future in maintaining international disputes and the extension of the rule of law on the world. And, as furtherance of President Nixon's proposal for the peaceful use of space, we suggest that the United

Nations take the initiative to develop a body of law applicable to the peaceful use of space."

"We are ready to negotiate and to stimulate realistic methods and techniques for disarmament, and for the suspension of atomic tests. We advocate an early agreement by all nations to freeze atomic tests in the atmosphere, and the suspension of other tests in verification techniques."

In the revised foreign policy plan, these words were added: "We support the President in any efforts he may make to reevaluate the question of suspension of underground nuclear explosions at the Geneva Conference fails to produce a satisfactory agreement."

Under economic growth and business, the GOP platform and employment must be raised to higher levels and efforts must be made to make even parity to produce the expanding overall economy.

The platform committee said the economy of basic income, encouragement of those activities in applied science which are pertinent to welfare of natural resources such as space energy, space exploration and national defense, and strengthening of government agencies involved in such activities."

The stated role in research, the platform suggested, should be in the area of basic research which industry cannot be reasonably expected to pursue, and applied research in fields of power and related areas, including space defense and exploration and use of space."

The platform added that it endorsed continuing by government agencies for research, and at the same time, will allow for reasonable charges for overhead and management in the conduct.

Foreign Policy

In the foreign policy platform, Republicans said:

• "We hold that military assistance to our allies during the recent emergency should be continued with all the vigor and funds needed to maximize the strength of our alliance of levels essential to our common safety. The firm

diplomacy of the Eisenhower-Nixon Administration has been supported by a military power superior in size in the history of our nation or in the world. As long as world tensions increase in this way, we are resolved to maintain as strong a position as can be by our

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The platform committee said it assumed a high priority to vigorous economic growth and recognized that by assumption lies in the private sector of the economy. "We report," the committee said, "the measure of artificial growth forced by excessive new federal spending and loose money policies."

The platform added that the only effective way to reverse this growth is to increase the traditional strengths of a free economy—initiative and investment, productivity and efficiency."

The platform recommended, under government administration, that tax policies be established to help the President in the areas of field of aeronautical and industrial efforts, and in governmental planning and usage needs.

The platform also said: "We urge undertake further reorganization of the Defense Department to achieve the most effective utilization of defense planning and research, and improved transfer of interest less should be used for vigilante protection of the public interest and to remove determinants to governmental service by our ablest citizens."

Thomas Leaves TWA

New York—Charles E. Thomas resigned in protest, chief executive officer and a director of Trans World Airlines last week. Thomas, who had just completed two years as TWA president, and he resigned at the end of the two year contract to "return to his family and other interests in California." In accepting his resignation, the TWA board of directors said there was no immediate successor under consideration.



SOVET TU-14 Badger was photographed by USAF over the North Pacific. Note pod under wing for electronic reconnaissance equipment.

Soviet Veto Stops RB-47 Investigation

By David H. Hoffmann

New York—A Soviet veto on the U. N. Security Council last week scuttled a U. S. resolution calling for an impartial investigation of whether the USSR's RB-47 that downed by the Russians on July 1 had actually penetrated Soviet airspace.

The Russian rejection of the proposal followed U. S. Ambassador Henry Lodge's revelation that Soviet Air Force Tu-16 bombers regularly went flying electronic reconnaissance missions along Alaska's western perimeter and had been "seen."

One such flight, Lodge said, penetrated U. S. airspace 5 miles off of St. Matthew Island in the Bering Sea. The aircraft presumably was a Soviet missile to probe Alaska's early warning radar defenses.

In the same session of the Security Council here, the Soviet Union voted an Indian resolution that would have enabled the International Red Cross to make contact with two of the downed RB-47 crewmen now being held by the Russians as charges of espionage.

Nine of the 11 nations represented in the Council favored the free resolution. Only Poland voted with the USSR in its vote on 8th and 9th votes last Tuesday night.

Earlier, the same nine states voted

down a Soviet resolution that sought to "condemn" the RB-47 flight as an "aggressive act," while "urging" that the United States call a halt to electronic reconnaissance missions.

During the three-day debate here, Lodge contended that the RB-47 was forced by a Soviet fighter to fly around through the Bering Sea along a course stated in Russia's Komsomol Press.

Flying en route from the Arctic Ocean

to the north, the fighters delayed the bomber's intended return from the coastline—a turn intended to take place 50 miles west from the nearest Soviet station, Lodge said. The flight's trajectory apparently was designed to bring the United States and Great Britain free from the powerful NATO radio station at Vardø, Norway, brought the RB-47 to a point 10 miles off the tip of the Kola Peninsula.

"This is the closest it ever was to the territory of the Soviet Union," Lodge declared.

Russia had contended that the reconnaissance mission had not shot down 15.67 mi. south of Semyon Novy Cape in 1501 Gavrovsko village while flying toward the city of Archangelsk. But Lodge maintained that the plane disappeared at 1522 GMT, some 209 mi. from Semyon Novy Cape, in the opposite direction.

According to Lodge, the RB-47 was heavily instrumented with navigation radio that enabled a constant cross-check of its position with respect to the Russian coast. Moreover, the crew were to "make a special check, to assure themselves that the radio was functioning properly," before overflying an airway line 75 mi. out from Russia territory, Lodge said.

These precautions, Lodge told the Council, were taken because the crew knew that "the Soviet Union had in the



SOLID BLACK Inc. of Bauma Sea map shows track of RB-47. First X marks spot where Soviet down plane was downed. Second X indicates location where plane disappeared from U.S. radar maps, while looped line to the south follows RB-47 flight based by Russian flights. Dashed line projects plane's intended course.

past land planes towards its frontier" (AW July 13, p. 10).

Contrasting the RB-47 flight with comparable Soviet flights of Alaska, Lodge said no similar instances in which Russian reconnaissance bombers had approached the U. S. coast at

distances of less than 30 mi.

Lodge said it clear that the Soviets were probing the northwest on approaches to the United States from Pt. Barrow-Alaska's northern extremity where one of the six DEW Line radar stations is located—*i.e.* St. Matthew Island—about 750 mi. east of Anchorage.

He gave a brief description of his illustration, displayed before the Security Council, the diagram traced the course of the Soviet missile Vega, which collected electronic data along the United States' eastern seaboard April and May.

Russia's statement that it will "take other measures" if the hearing continues (AW July 21, p. 10) is "ridiculous," he responded. After recent Soviet statements and actions, the State Department said, U. S. officials "are determined to take whatever steps are necessary to approach this issue more seriously, but that identification is sometimes necessary—in the case of the Soviet electronic fighter craft Vega, which ostensibly was a flying missile."

In an indirect reference to Russia's shooting down of a USAF RB-47 last July 1 (see p. 10), the U. S. said it prefers with interest Russia's concern over fears of the war and hopes Russia "might now begin to inspect that first down in the part of other nations, whether for ships or aircraft."

Conceding that the preoccupation of maps was a shared concern, Vladi V. Kostromin, a first deputy defense minister of the Soviet Union, said these two questions to Lodge:

Why, if the United States was aware

of the precise point at which the RB-47 disappeared, was the subsequent search not begun there? And why, if the plane was on a sensible mission, was it attracted to penetrate into Soviet airspace?

The impasse has led, as noted previously, to an extension of the Council's mandate to include the U. S. and Soviet versions of the RB-47 incidents. Many observers here felt that these two investigations, ordered by the Council had been started more from riding directly with the United States in its handling of the U. S. incident last May.

Two of the four, Ceylon and Argentina, recommended the creation of close-premission reconnaissance flights, even when such flights transited over international waters, as a means of improving international relations. All, including the United Kingdom, France, Italy and Switzerland, also agreed that the question of proving whether the RB-47 flight was "hostile or aggressive" still was open. The Soviet Union said that the Soviet Union had failed "to make an end."

Sir Peter Dean, delegate from the United Kingdom, asserted that Soviet missiles equipped to intercept radio transmission and "electronic surveillance equipment" frequently sailed close to British territorial waters, especially when an oil exploration or military research project was in progress. "When an entire mode of early detection 'was once overlooked or overlooked' by the USSR, the Security Council should have been made aware of it," he said.

He gave a brief description of his illustration, displayed before the Security Council, the diagram traced the course of the Soviet missile Vega, which collected electronic data along the United States' eastern seaboard April and May.

On Aug. 26, Lodge said, the Vega made its first appearance about 205 mi. southwest of Cape Cod, Mass., crossing an area in which the U. S. had set up a weapons range. The Polaris missile program was testing the Polaris missile guidance system. Dismantling instruments from a S-300 missile to stand alone, the Vega, according to Lodge, actually attempted to retrieve a "loose test vehicle" discharged earlier by the George Washington. The missile missile was recovered by the USS Niagara, a support ship, only after sharp maneuvering had averted a collision with the Vega, Lodge said.

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CHART plain courses of six Soviet front flights that approached Aleutian coast during 1959 and 1960. Thin line coverage on St. Matthew Island, north of the Aleutian chain

NASA Plans Three-Man Spacecraft

Washington—Space Agency study contracts for Project Apollo, a three-man capsule that will be the follow-on to the Mercury manned capsule, will be awarded in the next few weeks. National Aerospace and Space Administration and last week in leading some 8,100 industry representatives on its plans for the next 10 years.

Systems contract design, engineering and fabrication of Apollo and its own program probably will be awarded in fiscal 1962, NASA said. The vehicle would consist of a command center module, a propulsive module and a service module. It would weigh about 10 tons as an earth-orbiting laboratory and later for moon-orbit rendezvous flight.

Research and development and prototype flights are expected to begin in 1965 and end in 1968. Study tests would use the Mercury-type B vehicle. Full-scale spacecraft will require use of the Saturn V rocket by 1969.

NASA also told contractors it plans 86 scientific payloads, averaging 3.5 hours and planetary flights; 41 launches related to manned flight; 25 launches for satellite applications such as communications; and 62 launches to conduct development tests the next 10 years.

Planning agency says no decision will be made until early 1962, but industry of these proposed projects, most of which already have approved.

• **Aries.** Meteorological satellite to be placed into 23,000-mi "satellite" orbit by the Centaur vehicle. Not approved yet but may be authorized in October 1961 with first launching in 1964. Contractor for the National meteorological satellite (now 23) system, retargeting and basic structure will be picked early this fall.

• **Atlas-Surety and Prospector.** Surety will be a two-stage satellite launched by Atlas-Agena B. Prospector will be a one-stage satellite launched by Centaur and weighing 300 lbs. For the former, and Prospector will be launched by Centaur to land a module kilometers on the moon that would have a traveling radius of some 50 mi.

• **Mars.** Early planetary probe to Mars and Venus, weighing 600-1,200 lbs and launched by Atlas-Agena B. First one may be flown in 1962.

• **Venus.** Later series of planetary probes, launched by Juno to orbit Mars and Venus and probably carry interplanetary capsules for atmospheric entry and perhaps landing.

• **Rathdown.** Network of passive communications reflectors, a follow-on to Echo experiments. Tissue Research Center now is evaluating bids for studies of ways to make large reflecting surface rigid. If studies are successful, they may lead to launching a network in 1962. Rocket-boosted satellite inflators, probably would consist of 32 separate units, each to be carried by a single Centaur. No specific contractor has been selected for the project.

Apollo is expected to be able to support life in a period ranging from one week to two months at an earth-orbiting laboratory, or about a week for the circumlunar mission. Manned capsules would be changeable to meet the mission. Crew of three is feasible, as are many aspects of the program. Most reports will be influenced heavily by the outcome of Mercury flights.

NASA's current and space flight master over joins very detailed program goals for the Apollo second module and says and are engaged now in intensive research and study programs. This analysis will be made available to industry—probably through a series of briefings or the program manager will be an extension of the escape committee held at headquarters here last week.

NASA Administrator T. Keith Glavin and industry will meet on reviewing production of NASA's workload involving many major engineering and project cost agreements. He estimated that more than 75% of the expected \$1.5 billion a year NASA budget will be spent on contracts. No new major NASA installations are planned elsewhere.

News Digest

Two deployment-type Atlas E models have been redesigned as Atlas series—the Atlas V. First test deployment is at least a year away at Vandenberg AFB, Calif.

General Electric will develop new altitude reentry vehicles at its Philadelphia plant for the Mark VI reentry glider flight for the X-20.

Vehicle for the Titan II under test must be resold by USAF.

Ten Strategic Air Command generals have assumed posts of chief in SAC's Boming, KC, SST, airborne command, and during two-weekly peacetime exercises.

Martin Co. has named Holmes M. Renshaw as the new president of corporate director of communications. Joseph M. Renshaw will continue to be corporate

director of information services and advertising under Boeing's overall supervisory status. Renshaw recently resigned as project manager for the Ford Motor Co.'s Head Division.

Dr. John F. Vietnam, first vice-chair of the National Advisory Committee for Aeronautics has retired after 45 years with NACA, and his successor the National Aeronautics and Space Administration and almost 52 years of continuous government service is Dr. W. H. Hodge, former NACA geophysicist and now director of aeronautics when it was absorbed by the space agency on October, 1958. Since then, he has been special consultant to NASA Administrator T. Keith Glavin.

Chicago Helicopter Airway Studios S-NIC marked its 10th anniversary about half way between Midway Airport and O'Hare Airport last week, lifting the 17 passengers and two crewmen aboard.

McDonnell Aircraft Corp. has applied to the Civil Aeronautics Board for a certificate as supplemental aircar or helicopter and aircraft operator. McDonnell's proposal would operate the same with DC-8, Aero Commander and "such other types of aircraft as may be appropriate."

Hiller Aircraft Corp., Palo Alto, Calif., and Electric Avionics Co., Toluca, Mexico, are negotiating merger of the two enterprises.

United-Capitol Merger

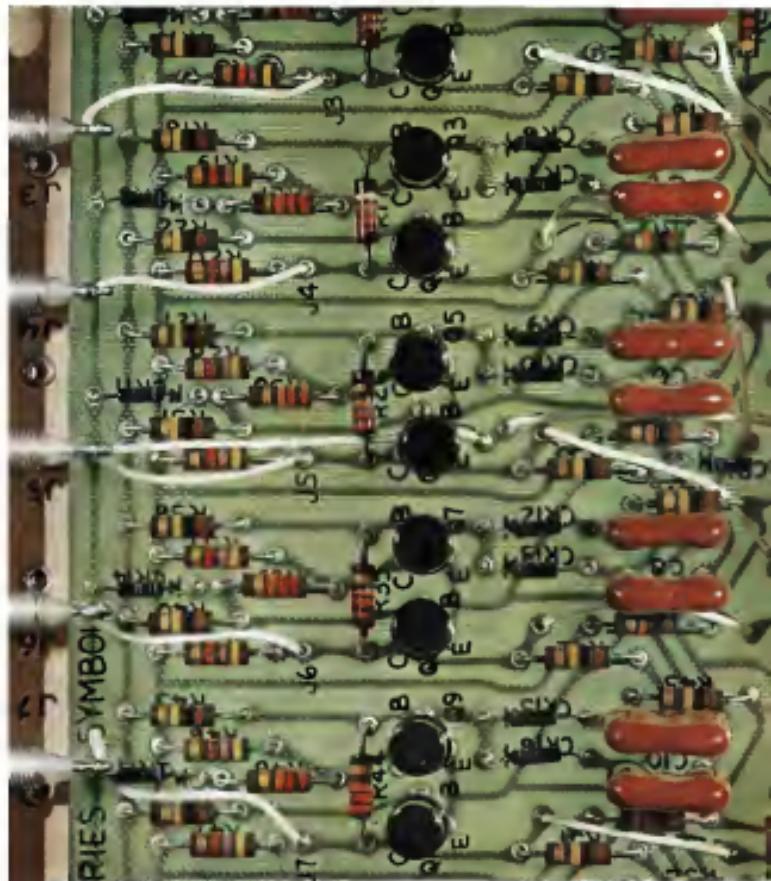
Washington—United Electronics plans to take over the Capitol Electronics Inc. as a means to expand its control here last week.

The two companies agreed to merge under terms which would give United common stock to Capitol shareholders and bondholders and would give Videx-Aerospace-Victor preferred and common stock plus 15 Victors to settle the British company's claims on Capitol. Videx will support the merger, which would be opposed by stockholders of the British company and by the CAP.

Under the agreement, Capitol stockholders will get one share of United common, plus a five-year warrant to buy 1.5 shares of United stock at \$40 a share for each seven shares of Capitol stock held. Holdings of Capitol's 42,959 common shareholders, debenture will be reduced 30 shares of United stock for each \$1,000 par value of debentures held.

Videx stockholders will get \$15.50 per share for their 5.9% non-voting preferred stock of United, \$0.600 per share of United common stock and 75 warrants to buy 20,000 shares of United common stock at \$45 a share, plus the 15 Victors.

A100-60-010 QMFT, August 1, 1960. Martin logged its 620,156,000th mile of space flight.



Without electronics it is impossible to design, build, test, launch, guide, track or communicate with a missile. That is why 40% of Martin's 7,500 engineers are electronic/electrical engineers.

MARTIN

AIR TRANSPORT

Lockheed, Airlines Plan Electra Changes

Modifications begin in November; speed restriction keyed to tests, which could dictate more changes.

Washington—Lockheed Aircraft Corp. will begin its Electra modification program in November, but current speed restrictions will not be lifted on the modified aircraft until reevaluation tests are completed.

The tests, which are now being conducted in Lockheed's wind tunnel at the National Aeronautics and Space Administration, are slated for completion sometime next summer (AWW Apr. 25, p. 46). It is quite possible that the final results of these reevaluation tests could dictate further modifications beyond those incorporated in the present planned program before the airplane can be flown at the normal cruise speeds for which it was originally certified.

A special Lockheed management-engineering team, headed by Burkhardt, has been following a series of meetings with 15 airline operators of the Electra to determine modification requirements. As of last week, 12 of the 15 airlines—Alaska, Western Airlines and Delta, Pan Am, Pan American and United—had reached agreement on the modification program.

The program calls for a reseating of the aircraft to the maximum to enter the modification bay, which is ganged to handle about 20 aircraft at a time. Lockheed will assume a major share of specific improvements only, which have been estimated at \$25 million, but the carriers will cover all following costs to and from the plant.

Modification programs call for a revision and stiffening of the pressure system and installation of additional aircraft systems, addition of webbing and much strengthened fittings in upper and lower engine support, structural加强件, and engine bearing. Strengthened members will be added to main gear, tailwall and main fairings will be strengthened. Wing skins from the fuselage, not found the wing rigs will be strengthened, and many unnecessary ribs will be removed by the addition of skin fairings.

In addition, Allison Division of General Motors Corp. will be responsible for heating to the inner duct of the main engine nacelle. This improvement has not been directly associated with the reasons behind the modification undertaken by Lockheed. Work on the modification program began July 5 with an Electra which will be moved over to the Lockheed Propulsion Flight Test Department Sept. 23. The airplane will be fully instrumented with strain gauges to undergo thorough flight evaluation. First Electra modified for certification by the Federal Aviation Agency is scheduled to be ready by Nov. 16. Target

for the complete modification is Dec. 16.

Initial flights of the aircraft through the modification program are the aircraft which has been stripped out for Electra modification, which is currently at (AWW July 25, p. 38). Evaluation of both aircraft enters the program on Nov. 17. Lockheed's schedule calls for five aircraft at a time, and it is expected that modification of the airline's current fleet of 31 will be completed by July 1968. Eastern will have three of its 40 airplanes out of service at a time between Nov. 17 and Jan. 1. The first will return Jan. 1 and April 1 and return out doors May through June.

At the present time, there are a total of 137 Electras in operation. 78 of which are operated by foreign flag carriers. Total of 73 Electras are an order for later delivery.

Chief problem facing Marjorie Biggin is the long-time involved in moving the aircraft into Burkhardt's modification. Australian airlines, for example, anticipate that each airplane will be out of service for at least six weeks compared with the 30-day period each Electra will be out of service in domestic operations—including down time. Most carriers are reporting losses of six months.

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uled to obtain revenue losses during the modification process, although several airlines will fill the schedule gap with piston-engine planes.

Western Air Lines and National Airlines are still in the talking stage with Lockheed on the proposed agreement. Northwest and Braniff have reached agreement in principle and are expected to be flying Electras shortly. Northwest is selling a schedule that calls for modification of its more aircraft at a rate of three at a time.

The reevaluation tests are a program separate from the modification program. Second test (spare) (AWW May 28, p. 46), the reevaluation tests are being conducted by Lockheed with the cooperation of NASA, which is acting as a technical consultant to the FAA. FAA will make the final decision whether further modifications are required after the results of the reevaluation tests have been analyzed and studied by the agency in consultation with NASA and Lockheed.

Original flight restrictions which were to stand until the tests were completed were set at 273 kt. calculated speed of March 35, at the normal operating speed (AWW May 28, p. 46). This was later reduced to 235 kt., which is the current speed restriction (AWW Apr. 6, p. 45). Original normal operating speed was 324 kt.

The reevaluation test program calls for a full series of original loading and structural tests and a review of all observed data pertaining to the aircraft performance characteristics.

Flight tests will be conducted in the highly instrumented Electra now being modified to simulate stress on the aircraft in turbulent areas. In addition NASA is conducting wind tunnel tests at Langley Field to check out Lockheed's flutter systems. A third phase of the program calls for a series of static tests. No decision has been made yet whether a joint investigation with an Electra will be conducted.

Approximately 200,000 air miles have already been covered on the reevaluation trials of the Electra's airworthiness. At the time the test force was assigned to the job, reached a peak of 160 persons. In addition, staff engineers of CNA, NASA, Boeing Airplane Co., Douglas Aircraft Co. and Northwest Airlines worked in close cooperation in the overall reevaluation program. Details of the testing plan were worked out by the two agencies, and each has been active in interpreting findings that fit



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Sinclair AIRCRAFT OILS



Sinclair Refining Company

Aviation Sales, 500 Fifth Ave. - New York 20, N.Y.

American Earnings Drop

New York—American Airlines net earnings for the first six months of 1968 totaled \$141,000, down from \$31,381,000 for the same period of 1967. Sales of passenger tickets \$349,000 per seat mile, for the first half of the year, compared with \$349,000 for the last half of 1967.

The airline's revenue passenger miles increased 24% to 3,225,000,000, the coach traffic revenue being 46% and first class up 12%. Air freight ton-miles up 29% to 14,714,000 ton miles.

Non-Union Pilot Seniority Issue Sparks ALPA-Southern Dispute

By Robert H. Cook

Atlanta—Prospects for immediate settlement of the seven-week-old Southern Airways pilots' strike appeared dim last week as management and labor refused to give ground over issues which involved a dispute between the Air Line Pilots Association and a major division among the unions.

One of the ALPA-Southern dispute is the issue of non union pilots hired by the airline when the main pilots left their jobs. Southern says that these non-union pilots were retained with top priority after the strike started, a condition ALPA refuses to accept.

ALPA has threatened to pull half of its flight crews to cities served by Southern in order to either force the Southern to give up the non-union pilots or to threaten other service operations to those cities. This threat was being countered in court by American, Board of Control, Delta, Eastern, National, Trans-Texas and Trans World Airlines, the carriers which would be affected.

These carriers have sued the U.S. District Court in Chicago for a restraining order and injunction which would direct their pilots to ignore Southern's non-union pilots. Instead of cities which would affect us cities, leaving about 100 cities, the restraining order covers all 140 cities of major airports after conferring with Atlanta Mayor William B. Hendfield, who has made several attempts to mediate the dispute. Cities are Atlanta, Ga., Birmingham, Huntsville and Mobile, Ala.; Jacksonville, Fla.; New Orleans and Monroe, La.; Jackson and Greenville, Miss.; Spartanburg, S.C.; Charlotte, N.C.; and Memphis and Nashville, Tenn.

ALPA is using the court action punitively and says the union is prepared for a long, drawn-out battle. Southern has never stated it intends to return its non-union pilots and expects to restore access to all of its 41 cities by negotiations with a full schedule of pilots in service by October.

Presidential Board

An ALPA sympathy strike could trigger operation of a general contract (non-fair funding board) which would recommend a solution and which the union indicates it would support under the premise it is related to the strike issue or arbitration. If the courts has the sympathy strike, the National Mediation Board will be forced to make an emergency board to hear the dispute.

Although ALPA has not carried out its sympathy strike threat, union leaders indicated that it will have a

significant effect on franchise business in the Southeast.

Delta Air Lines estimates it is getting 10 to 40 reservations simultaneously at Atlanta and that it handled 3,100 fewer passengers last month than in July 1979.

The airline said most of the non-unionists have come from carriers who caption them that are ahead of the labor dispute right now in terms of improved connections and reservations for overseas trips. Eastern Air Lines reported similar differences and estimated that Atlanta bookings were down 10% from the same month last year.

Few of the airlines could immediately respond to an interview citation of the fact that they had already lost 10% of their average daily departure of 3,000 passengers on the main airport traffic last month due to the strike.

Negotiations between Southern and its regular pilots began as July, 1979, and continued in October when the National Mediation Board announced jurisdiction over the airline. NMB also issued the order on Oct. 12. Following the filing of a complaint received under the Radcliffe Labor Act, the union set a May 4 strike date, but withdrew it to participate in three mandatory mediation conferences called by the NMB.

Mediation Fails

Further discussions were abandoned, and a Jan. 5 strike date was set after an NMB suggestion that the issue be submitted to arbitration was accepted by the union and rejected by ALPA. These efforts stalled with the NMB, called at the insistence of Mayor Hefner, until the strike began, also have failed to break the deadlock. Shulkin gave \$575 to \$50 million benefits from a special ALPA amendment.

Southern was forced to drop its flight schedules from 60 a day to only four and furloughed 530 employees out of total personnel of 800 as an immediate result of the strike. Many furloughed employees have gradually been recalled as the airline has seen new service since Jan. 5. As of Jan. 10, the airline had 20 and flight Southern first class, 25% of its total average plane seats in job, and in the first month of the strike earned \$811,300 in commercial revenue, compared with more than \$1,000,000 for the same month last year. Load factors which averaged about 54% at the time of the strike were 54% on four flights in July, the company said.

Southern has employed 75 new pilots and said it is continuing to recruit from outside its organization, and some of which are from other carriers. About 10 of these new men have been checked out and are flying the line. Southern can enter the cockpit upon completion training and a Federal Aviation Agency check within three weeks on a schedule that is now pending the strike's end.

ALPA maintains that its working conditions demands are merely an attempt to give the new contractual advantages already in existence on our main franchises and major hub senior airlines and in such they can not be turned backbuilding. Striking pilots say they are willing to continue the

existing terms, but not at the expense of assigning Southern's 10 months that they be placed on the bottom of the seniority list.

According to the airline's seniority system, pilots with seniority of 10 months or less would return to work, and those would be senior men with 11 years or more experience who would find themselves as a lower seniority than those non-union pilots employed by Southern's seniority of weeks.

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Both union and management were initially in agreement on salary provisions which would provide an eight cent increase per hour for half hours and half hour schedule to \$15.50 for each hour of work. This salary would amount to \$13.73 for Martin 404 aircraft fuel of which will be supplied by the end of this year, Southern said. The airline added that prior to the strike it had offered the pilot increases which would have brought salaries to \$18.10 annually for senior captains or Martin equipment.

The striking pilots generally agree on the salary provisions but tend to claim an extra offer of larger per hour or grounds that they have no assurance the company is going to Martin equipment. Thus the higher pay would only apply to a fix amount of compensation in the last six months of the contract.

Comparing contract proposals submitted by both parties on July 11 and 12, ALPA dropped its demands for a flat rate which would provide one hour of pay for each hour least away from base to acquire normal contract provisions which provide for straight flight time. ALPA added a note claiming that the airline's current fuel cost out of its regular stations is 10 cents per gallon which Delta contributes 25% of the price, and Southern 45%. Southern's position that while the fare we would have to cost an extra \$18.10 annually as exception of the full premium plan would cost the company \$75,668.

ALPA also wants as 85 to 90 flight hours, which would provide for one month non-reimbursable living from such as training as deadhead flights, would apply for both pay and annual flight time increments. The strikers insisted that this is a standard provision on many carriers, but Southern contends it is not needed since their pilots have usually averaged 76 flight hours a month. The pilots want at least 2.8 hours credit and pay for one time unless be-

average wage of the striking pilots. Southern adds that the non-union pilots can average a little better pay than union under an incentive plan that provides an extra allowance of at least \$100 per plane pay day for each flight in excess of 8,000.

The airline also argues ALPA's contention that the non-union pilots either as surplus or inexperienced for these positions and contend that in a group of 30 captain level, average flight experience was 80,980 hr and average age was 39. A large percentage of non-union applicants have come from American citizens who formerly were employed by foreign-based operations such as British Airways, American-Airlines Co. Co. and several South American airlines.

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one of training programs, as grounds that this could bind themselves in a position of being assigned to training for as long as two weeks and then being forced to fly 60 hr in the remainder of the month without any opportunity to earn an extra pay plus pay for each flight in excess of 8,000.

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other operations throughout the Southeast as compared with the "Seneca rights of the public" and promises to take immediate court action should any move be made to pocket or interfere with operations at the Atlanta International Airport.

FAA Limits Insurance Hopes Airports Follow

Washington—Federal Aviation Agency clamped a ceiling of \$16,000 last week on the amount of airline trip insurance a passenger may purchase at the Washington National Airport for a single flight.

FAA, which operates the airport for the federal government, hopes the limitation will be introduced at other commercial airports throughout the U.S. Some insurance companies, like Travelers, are seeking to raise their rates, but FAA Administrator James D. Gandy told Aviation Week that an injunction in dictated substantially larger amounts can be purchased at a number of large airports in the U.S.

For purposes of the FAA move is to reduce the cost of trip insurance premiums and to discourage travel dealers to a means of collecting on insurance. The agency notes that Southern might get larger equipment requiring a much larger sum. The airline new policy is effective Jan. 15 to Dec. 31.

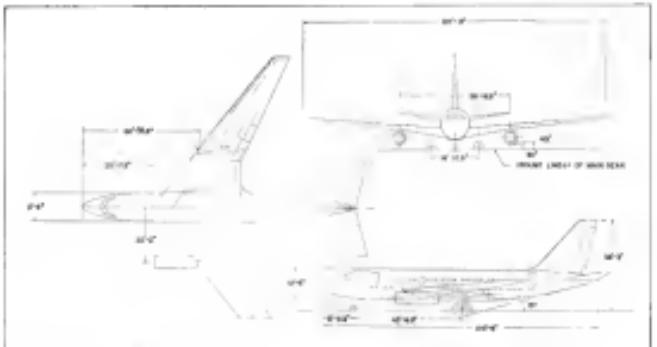
Anti-Violence Measures

Southern got an unfavorable injunction against the strikers in both Atlanta and Memphis after reports that the property of one of its non-union pilots had been vandalized. In addition, the airline has guards around its hangars and a special guard for training non-union pilots housed in an Atlanta hotel at company expense.

ALPA denies the vandalism charge and says it has offered a reward of \$100 for any information leading to the arrest of the alleged offenders. Southern, for the Atlanta local contact, said that the vandalism charge was brought in Southern's name as a means of getting the strikers separated and creating good publicity for the strikers.

Striking pilots view their demands as an effort to gain pay and working conditions on a par with pilots employed by airlines with unionization status.

Major Hardtold told Aviation Week that he greatest concern over the issue, which should have remained on a local basis, was the entry of an "international organization" in the strike and the threat it poses to the public interest. He takes particular issue with ALPA efforts to shut down



Convair's proposed short-haul jet transport, the Model 60, has extreme configuration similar to the Convair 880.

Convair Surveys Market for Model 60

Washington—Convair Division of General Dynamics Corp. is conducting a market survey for its proposed short-haul jet transport, the Model 60, which can be available for delivery approximately two years after initial orders are signed.

Designed primarily as a replacement for the Convair 880, 340 and 440 series, the Model 60 is a single-engine transport powered by two turbofan engines to meet requirements for a high capacity, high-speed, short-range transport of a low-cost payload per airplane seat. It will sell for \$1.5 million.

Potential Customers

Performance figures proposed by Convair are based on the test of two Pratt & Whitney JT8D-10 turbofan engines, each rated at 20,000 lb. of sea level static thrust. Standard performance may be attained with two General Electric CFM5-51CL turbofan engines, rated at 22,000 lb. of sea level static thrust each. All engines are planned to be mounted under the wings.

The Model 60 complies the aerodynamic, structural and systems design of the Convair 880 and 600 transports with an engine configuration similar to the 880. Wing area of the Model 60 is 2,000 sq ft and span is 120 ft. Wing sweep is 15 deg at 10% chord. Dihedral is seven degrees, root incidence is two degrees and aspect ratio is seven. The wing will be equipped with double

slotted flaps and extendable slats on the leading edge.

Passage length is 109 ft. 5 in., with a maximum outside width of 11 ft. 6 in. Maximum height of the fuselage is 12 ft. 5 in. Forward lower deck compartment will have a capacity of 385 cu ft. At full lower deck will have a capacity of 255 cu ft.

Total of 17 seat rows with a 38 in. seat spacing in a four-across configuration will provide 60 seats. Frequent passenger seating arrangement will provide a total of 52 passengers.

Pasenger windows 9 x 12 in are located two to a seat row. Airplane has a maximum speed of 550 mph below the transonic region. An airplane seat is located behind the pilot.

60-Seat Version

With a 60-passenger configuration, the Model 60 will have an operating empty weight of 35,600 lb. Flying weight with a normal payload of 36,949 lb and maximum fuel weight of 44,000 lb is 139,545 lb. With maximum payload of 60,000 lb, range weight is 141,400 lb.

Using the 88-passenger configuration, airplane has an operating empty weight of 30,560 lb and a range weight of 141,395 lb with a normal payload of 33,075 lb and maximum fuel weight of 44,800 lb. With a maximum payload of 19,965 lb, range weight is 144,425 lb.

Maximum takeoff weight of the Model 60 is 145,500 lb. Maximum zero fuel weight is 100,000 lb and maxi-

Air Defense Exercise

Washington—Committed forces operating in the continental U.S., Canada and Alaska will be required to prevent an attack on the U.S. over period between 3:00 a.m. and 7:00 p.m. on Sept. 20, 1968, and on Sept. 20, 1969, as a North American Air Defense Command exercise named Sky Shield which will be conducted during that period. Exercise will employ entire air and electronic systems used in air defense.

Minimum landing weight is 140,000 lb. Minimum range required with maximum range thrust at 115,000 lb. At cruise weight it is 536 mph at 35,500 ft, 545 mph at 25,000 ft, 576 mph at 30,000 ft and 572 mph at 35,000 ft.

Reway requirement at sea level with a four-seat rear cargo payload and an S-550 lb fuel reserve is 3,700 ft at standard temperatures when operating at a 200 mph sea flight. At standard temperatures, operating over a 1,100 mph air mass, runway requirement is 5,175 ft.

For the same range, but at 90°F, runway requirement is 5,470 ft. Landing range requirement is satisfied at a maximum landing weight of 140,000 lb. 5,050 ft.

Operating with a minimum range requirement of 3,700 ft, an intermediate point, designated as an intermediate point.

In another aspect of the consolidated planning, which involved application of some 11 services, Hawaiian Airlines was the committee's recommendation for West Coast-Hawaii service.

Examiner Urges Hawaiian Airlines Be Awarded Route to West Coast

Seattle—Planning efforts are now underway in the U.S. to have reconsolidated by Civil Aeronautics Board Examiner William J. Madlack, whose division is the forthcoming Trans-Pacific Route Committee, set the need for "a new concept" consistent with the capabilities of jet transports.

Madlack recommended putting Pan American World Airways and Northwest Orient Airlines "in the upper front" with respect to West Coast routes for their transoceanic services, then coding a head-to-head and lengthy battle between the carriers by giving Pan American a great circle route across the North Pacific and giving Northwest a Central Pacific route on Hawaii.

To American, as the examiner's recommendation, world would be the long-haul part of East Coast and inland customers for its Pacific service, with the right to operate from Boston, New York, Philadelphia, Baltimore, Washington, Denver, and Chicago to the Orient, with Pacific designated as an intermediate point.

For the same range, but at 90°F, runway requirement is 5,470 ft. Landing range requirement is satisfied at a maximum landing weight of 140,000 lb. 5,050 ft.

Rough range of the aircraft with normal payload and maximum range flight at 35,000 lb. is over 1,600 miles. At 90°F, with speed reduced to 35,000 lb. at standard temperatures, range of the 85 passenger jet configuration model will be 1,480 miles per seat maintained over a 1,380 seat fuel range.

Eastern Air Lines is currently studying Convair's Model 60 for its short-haul regional airline operations. The airline has also chosen a transoceanic route for the Boeing 727. Other airlines, other than Boeing, have not yet indicated positive plans for building the transport. United has hinted that it is interested in a maximum of 45 Boeing 727s.

TWA, American Fined Heavily by FAA

Washington—The Federal Aviation Agency imposed especially stiff penalties on two major air carriers for new check and maintenance violations.

Twa World Airlines paid fine totaling \$12,000 for failure to have 70 flight engineers checked for incomplete or the 12 months prior to Apr. 30, 1969.

American Airlines paid fine totaling \$9,000 on seven maintenance violations, involving one case where the carrier failed to conduct an overnight loading inspection on an aircraft.

• **Examiner of Pan American's South**

Pacific route beyond Sydney to Japan.

• **Indicates** annual of Northwest's authority to serve points in Korea, Okinawa, and Taiwan, and of Pan American's authority to serve points in Viet Nam, Singapore, Sumatra, Java, Federation of Malaya, Thailand, Burma, and points within India and Pakistan north of the 25th parallel. Consideration is given to the two Americas of two Pan American mainline divisions. One effect is to assign Pan Am to fly directly between Newark and Tokyo.

In his findings, the CAB examiner detected the predominance in the first major international and oceanic route case in which the impact of jet aircraft must be considered and explained. While only "fragments" of jet experience presently exist, there is enough to establish that the new aircraft will provide almost double seat capacity, will have flight times, will provide increased efficiency per passenger-mile, will lower fares a good prospect, and will give extended nonstop ranges.

Great Circle Routes

Openly, he said that still much fall use of great circle routes will be made between major U.S. cities and points in the Orient. Economically, the new concept will ensure that traffic will be stimulated "to an extent and in an amount not heretofore matched as approached by any single incident or improvement."

Madlack found U.S.-Orient traffic forecast by several parties in the case to be within reasonable range, and the examiner selected route 1963 (volume of 250,000 passengers) as likely to be important. Of the total, U.S. carriers will obtain an average of 75%, the examiner forecast.

Pan American and Northwest, however, came up with distinctly different forecasts of the distribution of passenger traffic between San Francisco and Los Angeles and Fiji via Honolulu, Hong Kong, and Taiwan and Saigon, and saw authority to carry mail on a newly-authorized air line. Passengers are to be carried between the West Coast and Honolulu only on flights operating between Honolulu and Ross Field or beyond.

• **Consolidation of United Air Lines' route 118 with its route 3, substituting Honolulu for Oakland and Los Angeles, respectively, as a western terminal point.** Addition of San Diego as an intermediate point.

• **Examiner of Pan American's South**

Airlines, MATS Meet on New Contract Plan

By Katherine Johann

Washington—Seven air carriers are meeting with Military Air Transport Service to negotiate contracts which will recover the purchase of medium cargo aircraft for the civil air fleet reserve.

This is the first step in implementation of a new program under which MATS plans to abandon competitive bid procurement which has accounted for over 95% of MATS business in the past. Congress and industry have long objected that the competitive bid practice permitted carriers no incentive to increase their medium cargo fleets.

The carriers attending include: Air Midwest at St. Louis; American, AFB, Inc.; Pan American World Airways; Trans World Airlines; Northwest Airlines; Southwest and Western Airlines; United Air Lines; Alaska Airlines; and Delta Air Lines.

The conferences are dealing with contract terms for the segment of MATS passenger and cargo traffic on regularly scheduled commercial flights. This is one of three categories under the new USAF program (AW May 16, p. 39) now being approved by the Department of Defense. The others are: the Far American, Trans World, Northwest and Southwest—personally authorized air cargo; and MATS' own cargo fleet.

• Advanced "switchback" assault Air Research and Development Command

Conspiracy Charged

Washington—Oversight National Affairs will lead the Civil Aviation Board this week from June 10 until the Air Transport Association and its trade associations begin negotiations on the contract plan.

• Small business air cargo traffic.

The USAF program states that this will be "in a quantity sufficient to assure adequate participation by small business."

The deadline for negotiating new contracts is Sept. 30 when current MATS contracts, totaling \$42 million, expire. Two major objectives of USAF in its negotiated contract program are to obtain commitments from carriers to purchase medium cargo aircraft and to expand capacity available to MATS in an emergency or partial mobilization period. Carriers already have made commitments from their fleets to an off-emergency period under the Civil Reserve Air Fleet program. USAF has been unable to elicit fleet commitments for partial mobilization, probably because the extent to which a carrier's fleet might be withdrawn for military work would affect its competitive position with other carriers.

The Air Force program states that

advertised bid contracts will be restricted to the negotiated contract policy fails to provide an option or "price acceptable." DOD and DoA have agreed in this regard, according to the USAF program statement.

"It is understood that advertised competitive bidding will be used for the procurement of augmentation aircraft when there is no price acceptable to the Department of Defense clause he obtained through negotiation."

The original Air Force program would have made acquisition of MATS resources contingent upon the separate use of ramjet-powered aircraft by the estimated number. This was rejected by Defense Department, and now, alternative jet contracts will only be given preference. Defense also directed USAF to consider DC-10 and IL-76/HM cargo aircraft "as being suitable."

An Air Force spokesman told Aviation Week that carriers with Cessna CL-44s, the first turbine-powered cargo aircraft that will be available commercial aircraft, will have "the pick of the MATS business" under negotiations guidelines. The three carriers that have ordered CL-44s are Flying Tiger Line, Seaboard and Western, and Delta.

Meanwhile, USAF reported these developments in its program to negotiate MATS' own cargo fleet:

• Advanced "switchback" assault Air Research and Development Command

• The present lack of civil cargo capability necessitates the use of military units in cargo cargo which could go on civil routes if they had the capacity.

• The selection of MATS' channel flight operations is contingent upon two things being demonstrated. One is the overall capability of commercial carriers at acceptable and predictable prices and committed to the worldwide service task. The other is the amount of channel traffic that can be accomplished by the utilization of MATS assets and the ability to control execution of its various assault mission.

• There is no intention to eliminate MATS global route operations.

• An "income" in the amount of channel traffic given civil carriers would be commensurate with cost and expeditious production by civilian long range turbine-powered cargo aircraft made available at prices acceptable to the Department of Defense and comparable with the effective utilization of MATS' assets.

• When the development program is established for the advanced cargo type suitable for MATS and commercial operations, "consideration may be given to sharing the cost of development." In this connection, civil carriers may represent flight test and acceptance costs. Consideration may be given to sharing in initial delivery to make unit costs equitable between military and civil procurement.



Soviets Push Foreign Sales of Il-118

Soviet Union, satisfied that the Il-118 medium transport aircraft fulfills operational requirements, continues to push the aircraft in foreign markets. Czechoslovak Airlines, intent of foreign flag status to purchase the aircraft, is operating the B-74 on its Prague-Dresden-Berlin route (AW July 13, p. 50). Il-118 is also operating on Chinese Civil Air Service route between Canton and Peking (AW Dec. 21, p. 32) and on East German Luftfahrt route (AW Apr. 18, p. 45). Aeroflot, shown, is seen at Domodedovo Airport.

A. V. Roe Proposes Swing-Tail Assault Freighter Based on 748

By John Trantell

London—Avro 748, the research freighter version of the 748 turboprop transport, is being prepared to fly British and Indian governments by A. V. Roe & Co. Ltd.

The project would mount the 748 wing high on a new fuselage with a swing tail. Main landing gear would be attached to the fuselage, rather than to the wings as on the 748 (AW July 11, p. 118). The 748 cockpit would be retained.

The Avro 748 has made 20 flights for a total of 63 hr since the first flight on June 26. Avro chief pilot Jim G. Morrison and the research team test to light rates at maximum speed and between at least speeds. Tabs are being fitted as is as required to correct the fault without resorting to torque trimmers. Other wise, Avro reports no engineering difficulties with the aircraft.

On its first flight the 748 flew at the design gross weight of 20,000 lb and was equipped with all systems. The aircraft was sound-tested but not transited. The aircraft has since flown at its maximum design weight of 30,100 lb and to a speed of 278 kt.

Stalling characteristics have been investigated in various configurations, including full power at low speed and power commands. About 200 tabs have been made. The full range of gusts has been investigated with the aid of a vector bullet system in the wind tunnel which enables a full series of gusts to be made in 4 sec. An Registration Board panel has flown the 748 in all stability configurations.

The 748 test series was taken out of the flight program for three weeks for a structural check and for minor changes to the landing gear. Avro says the landing gear is being redesigned to eliminate wear problems in the parking brake and some engine changes.

Struct management of the cockpit throttle quadrant is to be made in 10 altitude intervals of a Davis navigator log. All warning lights in the cockpit are designed to go on prior to cockpit sheld, as in the Avro Vulcan bomber. As soon as all warning lights should be off.

Test flights have been made with both navigation aids installed, and a Wright is to release the pilot of navigation data.

The Avro 748 prototype is expected to fly in December. The first

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SHORTLINES

► American Airlines is adding a fifth daily transcontinental DC-10 all-cargo flight to its schedule this week. The DC-10, converted from the DC-10 passenger transport, will fly New York-Los Angeles with a refueling stop at Chicago. The four other daily DC-10 transcontinental flights make one traffic stop en route. The new cargo flight will operate as Air America's to San Francisco from Los Angeles.

► Japan Air Lines has leased from American Telephone and Telegraph Co. an amateur banding and tracking equipment capable of transmitting about 335,000 words a day and has integrated the equipment with its new extensive telecommunications network. Including U.S. offices with AT&T, others in Asia, South America, Europe, Africa, and Australia, the system will be used for international calls and telegrams. The Japan Douglas DC-8 comes from U.S. West Coast points to Japan Aug. 15.

► Scandinavian Airlines System is offering telephone teletype teleprinting. When a reservation is made, SAS sends the ticket via teletype, and it is printed on preprinted tablet paper as the charters' office SAS sees fit. It is the first foreign flag carrier in the nation to offer the service which is also used in some U.S. big cities.

► Shinkansen Air Lines will introduce blanket authority by the Civil Aviation Board to operate up to five trans-Pacific charter flights a month in return trips from Tokyo and Manila. The carrier operates 15 aircraft, mostly regional flights a month for the Mitsubishi Air Transport Service who co-owned and runs the members of the Japanese charter flight group. The airline was recently opened by Pan American World Airways and Northwest Airlines, which said there was no sharing of public funds for the proposed services.

► Transportes Aéreos Nacionales, S.A., has been granted a one-year extended temporary permit to operate flights to and from the Civil Aviation Board to allow the carrier to operate scheduled flights between Bogotá and San José, Honduras, and Manila via Balata, British Honduras. During the one-year period, the carrier must not operate from Manila to points south of Honduras.

► Vancouver International Airport has launched new construction totaling \$12 million under contracts just signed. Projects include a \$5.5 million Trans Canada Air Lines hangar maintenance base, a \$1.5 million, 7,300 ft runway and \$1.4 million for taxways.

AIRLINE OBSERVER

► Heliosair is experimenting with an Avon turboprop engine with a rear fan. Bristol is still pressing Vicker to consider an Olympus turboshaft engine with rear fan at the powerplant for the Super VC-10 transport, although the Olympus gas conversion is still only a design study.

► Boeing Airplane Co. is listing a \$6.25 million purchase price for its proposed Model 735, enlarged version of the 707 International freighter transport. Price is quoted to a maximum purchase of 10 aircraft, with delivery promised 18 months after a contract is signed.

► Pan American World Airways is not buying engines for its recently ordered three Boeing 707-320B freighter transports. The three engines will be purchased with the space-available rights in the early 1981 delivery, one of the additional Boeing that it will have no serial for new engines. Spare engines probably will be flown to Seattle and installed on the aircraft in the places they are delivered. Pan American attributes its present spare-engine position to success of its excellent base operation at New York and parts padding arrangements with foreign engine owners. The airline has optioned a fourth 707-SR, which would bring the fleet total of this model to 27.

► Watch for a contract between Pan American World Airways and the Department of the Interior to provide flight services to the Minami Islands, held by the U.S. in trusteeship under the United Nations. Pan American is expected to operate three Grumman S-61-10 twin-engine amphibians in the South Pacific area.

► Lufthansa Air Lines will introduce TWA planes and 47 flight engineers Aug. 22. Retiree programs on the carrier's Lockheed Electra, now used at Lockheed 707 Constellations and slow pace of jet deliveries are noted as reasons behind the switch. The airline warned that travel should not be anticipated before Sept. 1981.

► Seven United's B-18 turboprop transports, which are rapidly becoming the workhorses of Airfrance's fleet, have been carrying substantially larger maximum passenger loads than originally contemplated. Designed to handle 75-100 persons, B-18s have recently carried as many as 120 passengers on nonstop flights of 3,000 nm or more. Even the B-18's very short-haul regional model development-has no official capacity of only 125 seats.

► Expansion of commercial airlift of regular fastjet mail is continuing at a remarkable pace although the State and House have not agreed on the extent to which the Postmaster General may issue a mail service waiver until the source of adequate ground service or to terminate delivery. (AP July 5, p. 42).

► Capital Airlines last week received a one week extension in the deadline for acquiring a Vickery-Armstrong franchise and filed April 15 (AWW April 15, p. 18). Late last week, the company's board of directors was scheduled to take a referendum poll for submission to the Vickery group.

► Domestic whether American Airlines' San Francisco service need will withstand the challenge that the airline used "unproper influence" in winning nonstop right between New York and San Francisco or whether the airline will be required to give up its right on this issue of correspondence from congressional and other parties supporting American's case was answered by the Civil Aviation Board within the prescribed time for the filing of briefs and if copies of such correspondence were sent to all interested parties, thus allowing the CAA to make no violation of CAB's Rule of Practice. United Air Lines and TWA have strenuously opposed American's using undue influence in obtaining the nonstop right. The Board is awaiting the outcome of the case as ordered by U.S. Court of Appeals.

► Federal Aviation Agency last week certified the Pratt & Whitney JT3D turboprop engine which will power the Boeing 707-128B and 728B transports as well as the fan version of the Douglas DC-8.

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Disputes Rise Over New Capacity Policy

By L. L. Doty

Washington—A reshaping of U.S. foreign civil aviation policy that could force a break between the U.S. and at least three European nations is now in sight.

This policy change, which is designed to strengthen the comparative position of U.S. flag carriers, will become law later, will be put to its first test Sept. 12 when the State Department meets with a Scandinavian delegation in Copenhagen to discuss revision of a bilateral air transport agreement. The outcome of these talks will determine the course the U.S. will follow in negotiations with The Netherlands and Belgium.

In essence, the U.S. will seek to tighten restrictions on the volume of traffic carried from the U.S. beyond Scandinavia to other foreign countries by Scandinavia. At the same time, the airline consortium comprising Denmark, Norway and Sweden, U.S. air carriers will seek to widen the scope through a reciprocal exchange of traffic figures showing origins and destinations of passengers carried.

The Scandinavian will fight the proposed capacity restrictions because they envision the effects of the Fifth Freedom traffic handled beyond Copenhagen from the U.S. Domestic route to other foreign countries will result in cut into the carrier's revenues. It will oppose the proposed capacity restrictions, particularly the ones that would limit amounts of flag carrier passengers previously freighted under proposals—unless statistics are not squared under a Brussels-type agreement and positive industry figures should not be made public domain.

A deadlock on these issues at any future to reach some compromise agreement will undoubtedly move the negotiations up to diplomatic levels. The international organization major nations—the International Civil Aviation Organization—is due to meet in The Hague in October to discuss its tenth meeting to establish relations with the U.S. in October later this year (AW Sep. 12, p. 35).

Dutch Resolution

At that time, Dutch Foreign Minister Joseph M. A. H. Luns and the Dutch House of Representatives had adopted a resolution supported by all political parties that charged the U.S. attitude on road routes "does not fit into the relations between other EC countries" and was unacceptable. The Dutch Parliament had expressed such a strong statement about any ally.

Key to the controversy lies in the manner the U.S. and the three Scandinavian nations has in the widespread

differences in interpretation of the provisions of the Brussels Agreement—the air transport pact signed by the U.S. and Britain at Hanover, Germany, in 1946 which has since served as the prototype for all air transport agreements signed bilaterally by the U.S. with such as 53 nations except Czechoslovakia, Ireland, Spain and Turkey. The latter four countries are members of the Organization of the Chicago Convention of 1944.

The Brussels-type agreement has been upheld by both the U.S. and Britain, although these are liberal groups in both countries who are advocating a less stringent formula for basic agreements—one stipulation that would put an end to international wrangling over routes, capacity and more. Neither has been able to impose its will on the Brussels-type agreement.

As it was finally agreed, the Brussels Agreement was a temporary settlement between the liberal transportation philosophy of the U.S. and the more restrictive policy of the United Kingdom. Consequently, it is a rather new, ambiguous document that has enabled some "softly-sold" both and several Latin American countries—to impose still greater restrictions on the U.S. under protection programs through the regional wings or later reinterpreting of their agreements.

An airline industry suddenly is trying to realize a new benefit of competition on international routes, the usual toward

Five Freedoms

Washington—The Five Freedoms of the Air Agreement, which evolved as one of several outcomes at the International Civil Aviation Conference in Chicago in 1944, was signed by only a few of the 54 nations represented. In all of its bilateral agreements, however, the U.S. has retained the flexibility of these freedoms:

- **Fifth Freedom:** The right to fly across a neutral territory without landing.
- **Third Freedom:** The right to stop over in a neutral country.
- **Third Freedom:** The right to discharge passengers, mail and cargo coming from the home country in a foreign country.
- **Fourth Freedom:** The right to land in a foreign country passengers, mail and cargo destined for the home country.
- **Fifth Freedom:** The right to take on passengers, mail and cargo in a foreign country destined for any other third country, and the right to discharge passengers, mail and cargo coming from any such third country.

After arbitration on capacity offered by U.S. carriers appears to have gone, and with an increasing number of flag carriers now satisfied with routes they are operating into the U.S., there are few incentives remaining in bargaining wedge as U.S. attempts to block these restrictions. This has been particularly true in recent negotiations between the U.S. and Britain (AW June 22, p. 88). The U.S. has never forced capacity restrictions on any flag carrier in a series of existing negotiations, and it is a fact that, in most instances, the U.S. Autorization Board has imposed minor restrictions on a few foreign carriers as the spending provisions of foreign air carrier awards it has issued. But generally, most awards have been free to use U.S. air routes without any limitations on traffic volume other than those implicit in the Brussels principle.

Brussels Agreement

The Brussels Agreement said, in countervailing provide for a council of capacity. In essence, the capacity clause prohibits the actions of two countries from overstepping by keeping schedules aimed to traffic demand. The clause further requires that the excess of the home country will schedule flights between it and the opposite country via other countries on the route in "transit" schedules. Any schedules conducted by the citizens of the home country beyond the opposite country to domestic destinations in the name of "airways" traffic. Traffic carried in the latter schedules is controlled by the U.S. to no more than Fifth Freedom traffic (see box).

The "five freedom" agreement was evolved at the Conference of International Civil Aviation held in Chicago in 1944. The agreement was not accepted immediately, and Britain refused to ratify it. The U.S. signed it and, although it withdrew from the agreement in 1950, the agreement principles have remained intact and must be met bilaterally as transport parts.

Purposes of the capacity clause are to provide a measure of control over the five freedom principles by ensuring that schedules will always be closely related to traffic demand. However, since these are no established standards governing this relationship, capacity restrictions can be set by consultation between the two governments of the bilateral agreement.

The U.S. has insisted for title on capacity in the Brussels is accorded with the commercial traffic of each. It will attempt to pass a bill that SAS is not violating its Fifth Freedom—that traffic, according to

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Soviets Develop Taxi Version of Coaxial Ka-18

Variants of the known Ka-18 coaxial helicopter (AV Week 35, p. 87) have been developed as no. 101 by a Soviet design group headed by Nikolai Hish Kozhev. Aircraft is called Molniya (Lightning) and is powered by a 230 hp Avtodor engine. Range when used as no. 101 is about 110 m., but this drops to 100 m. when used as a taxi, carrying three passengers and the pilot. All seats

want dispute testimony that reported to date 95% of such traffic would be Fifth Freedom traffic originating in the Caucasus. It has been estimated that almost 100% of the traffic flows in Icaro-Aviation as its transnational route via Rostovsk in Fifth Freedom traffic.

Endorsed by Congress

The Transvaal Agreement as a prototype for bilateral agreements has been endorsed by Congress. It is supported by U.S. carriers and the State Department has now seen fit to recommend an intercountry formula in a basis for bilateral air transport agreements.

In 1957, an attempt was made to amend the Civil Aviation Act of 1938 by adding the Transvaal agreement provisions to the Act as a means of gaining higher control over Fifth Freedom traffic. The bill was again squared out of committee because the Senate Interstate and Foreign Commerce Committee was concerned that other nations might be tempted to introduce similar legislation in retaliation.

The State Department, however, is now under pressure from the airlines and the CAB to enforce capacity checks and has already asked Belgian, Rob. The Netherlands and the Scandinavian countries to provide origin and destination stations in a link step as the first test. Attempts by the U.S. to put in contact with Brazil, to have Inter-American Civil Aviation Organization (IMAO) collect data from all American airlines have not as yet been successful, although the program is under study.

It has agreed to provide the statistics, but The Netherlands, Belgium and Switzerland are resisting the request. They want clearer definition of

the country to ask that Smith Freedoms statistics be divided. Such information, they say, is outside the purview of the bilateral agreements.

Shiftless Policy

In recent years, the U.S. has assumed a somewhat shiftless role in the growth-and-collapse of negotiations with the Europeans on bilateral agreements. Statements in news media [AV Week 33, p. 86] have been attributed to that switch to a stronger position in behalf of U.S. carriers, although a number of airline officials charge that the U.S. gave away so many rights to foreign carriers in the early postwar years that the U.S. is now on the hogging rather than the donating side.

Creation of the so-called "in-country" polar of the U.S. marked a peak in 1953 when a series of routes into the U.S. were granted to Lufthansa. Since that time the U.S. has gradually tightened its beginning concepts under pressure from the CAB, the airlines and labor groups.

The polar policy has resulted in strained relations, particularly with The Netherlands, Italy and Argentina. The latest policy shift of reducing capacities, restrictions on Fifth Freedom traffic to the latter will undoubtedly spread this discontent to other nations.

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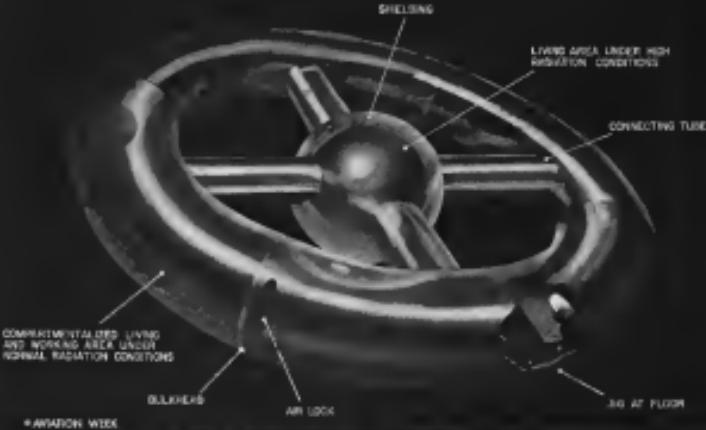
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SPACE TECHNOLOGY



AVIATION WEEK

MANNED VEHICLES operating for long periods in space probably will require large "shells" to shield their crews from radiation storms coming from the sun during solar flare disturbances. Vehicles with large internal volumes and big working spaces for their crews are planned for the third generation of manned space craft. Shielding of the crews against severe solar radiation is out of the question unless shielding is concentrated in a "shells" with a small living space inside. Measurements by scientists and balloons

Space Stations Require Radical Design,

By J. S. Bata, Jr.

Washington—Third generation manned space vehicles are scheduled to be relatively spacious and to operate for years without major repair. This means they will require design concepts and construction materials radically different from those used in the cramped, short-lived Mercury vehicle and the second generation Gemini and Apollo capsules. Internal working areas of up to 30,000 ft³ third generation vehicles will equal that of a small cottage, and large low-density structures must be used to enclose this volume if the structural weight is to be kept low. Current estimates are that accurate type structures and high density sheet metal structures will not be adequate for the passive vessel construction of large space vehicles.

Development of new low density, high strength materials for primary vessel construction has become a major objective of the National Aeronautics and Space Administration (NASA) [July 21, p. 28]. Composite materials using various types of synthetic resins, plastic and organic fibers as leaders of their reinforcing fibers and ways to increase high strength are being studied. A number of configurations of low density



NATURE of the pollution environment in space is just beginning to be understood. The level of background radiation beyond the Van Allen belts is too high, space travel there may be impossible until completely new shielding techniques and materials are developed. Recent studies show the best way for a manned space station is at an altitude of about 300 mi. at the equator.

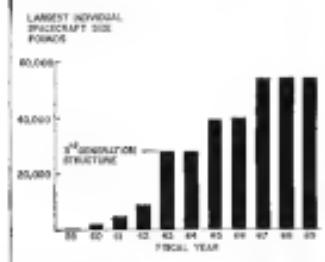
AVIATION WEEK, August 1, 1968



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have indicated that "shells" would be required during the missions right to 30 times a year when bursts of high intensity radiation move from the sun. These "shells" would weigh in the neighborhood of 30,000 lb. for two or three men.

Structures

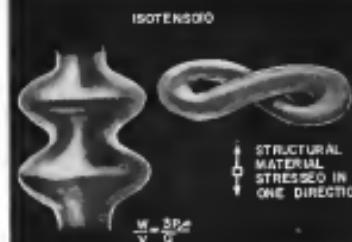
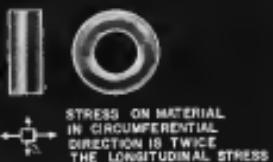


FIRST of the third generation, large volume space vehicles can be based on the spherical shape theory of Foster development programs do not stop. Early models of the space vehicle will probably be spherical. Spherical shaped generic vessel (right) is twice the cross of a man's vehicle is the lightest that can be built of sheet metal. Cylindrical or torus-shaped vehicles of similar volume and material will weigh 13 times as much as the sphere. Many shapes are possible if composite materials reinforced with wires and filaments are used.

AVIATION WEEK, August 1, 1968



CYLINDER AND TORUS



WHERE: W=STRUCTURAL WEIGHT OF VEHICLE
V=INTERNAL VOLUME OF VEHICLE
P=PRESSURE INSIDE VEHICLE
G=DENSITY OF STRUCTURAL MATERIAL
G'=ALLOWABLE STRESS OF STRUCTURAL MATERIAL



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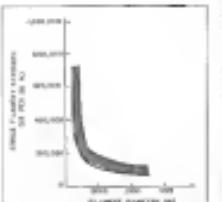
sheet metal sandwich are being investigated to determine just what types of core shape will best meet the pressure vessel and panel load attachment problems.

The continuing development of beryllium as a sheet metal structural material has been advanced strongly by NASA's Research Advisory Committee on Structural Design. Beryllium is 2.1 times stronger than aluminum and 1.2 times stronger than steel on a tensile strength-to-weight basis. If dynamic loading in the design criteria, it will be in most space applications, beryllium is even better because of a 6.7 times stronger than both aluminum and steel on a stress-to-weight basis.

The relative value of eliminating one pound of payload weight is about 15 lb. in total vehicle weight for an arcade, approximately 100 lb. in vehicle launch weight for a large missile and nearly 1,000 lb. for a space vehicle which can reach the moon or the mesosphere. The potential savings in total program costs through weight reduction in a space vehicle are believed to warrant the expense of overcoming the fabrication and processing problems of our thin beryllium sheets.

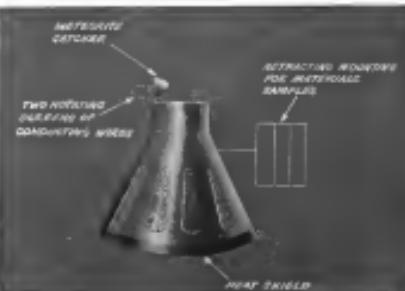
Design studies now in progress for the third generation of manned space vehicles are hampered because no clear understanding of the space environment is available and probable use will be available until the first of these vehicles is in service. Primary environmental unknowns are the speed, frequency and size of meteors and the type and density of solar winds as the sun during solar flares.

Data from Earth-orbiting and other planetary spacecraft can offer important, much-needed information on radiation and meteorites. The most important Earth orbits to the present infor-



COMPOSITE MATERIALS planned for intermediate pressure vessels are reinforced with small diameter wire or very fine glass radial filament which have a much higher working stress than ordinary glass fibers of the same weight. Thinner the reinforcing filaments, the higher their stress, as shown in curve.

AVIATION WEEK, August 1, 1968



RECOVERABLE SATURN/LIBIS to test structures, materials and enabling systems in space are planned by NASA. **Apollo** Work units' construction places recoverable down and extendable arms which will expose materials specimens and structural samples to the space environment. After exposure a sampled test unit will be brought back behind the heat shield and returned to earth without experiencing the heat of reentry so that changes which occurred in space can be evaluated through close study. Atmospheric reentry test of top of satellite is to enable small satellites and bring them back for study. The heatshield would be filled with a low density material, and fire protection wire grates in front of it would be used to give a close approximation of the speed at which the atmosphere is interrupted.

• **Basis of high energy particle probe** by the sun during solar flares.

It was determined from the data provided by the first satellites that most of the radiation trapped in the Van Allen belts around the earth has such a high energy level that it would be impossible for man to live in these areas for a long period even when protected by complete shielding.

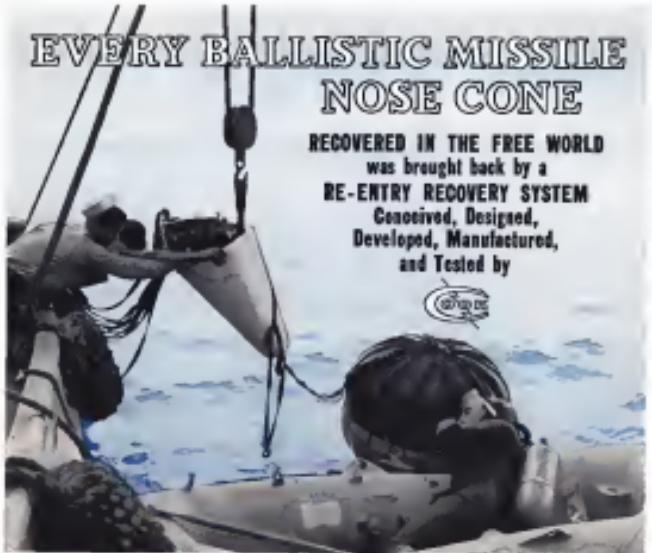
Particle energies in the outer Van Allen regions have been measured up to 200 MeV, which would give us an idea about how much solar wind would be needed to shield our atmosphere in short out bursts. Although particle energies in these belts vary considerably with time and position, satellite instruments to date have shown that they are so high that the shielding weight required for continuous manual flight in the Van Allen belts is not feasible.

• **Designated radiation** below the inner Van Allen belt at altitudes of about 300 m. or less have been found to be considerably safe for short-term research flights. This is the zone in which the Mariner capsule will make its three orbits. Radiation "storms" coming from the sun during solar flares will not be a problem with this type of flight because the capsule can complete its orbit and reenter the atmosphere before high energy particles reach the earth even if a flare is observed during the launch.

• **Crew safety** during long-term orbiting of third generation space vehicles in

EVERY BALLISTIC MISSILE NOSE CONE

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that requires no open to space question. Current data indicates that the heat-gated radiation will not exceed the maximum dosage limits used by NASA in its studies. These limits, which are the standards used by the National Bureau of Standards, are 0.5 mm increments equivalent weight per gram, 5 min protons, and 25 min total solar flares.

One of the first questions of all latitudes and altitudes has not been determined to date. Measurements made by balloons near the poles have shown that radiation levels with fluxes up to 2 rads per hour have reached the vicinity of the earth following a solar flare.

Maximum intensity of these radiation bands, as "storms," last about one day, and they increase the radiation in a given area for about a week to 10 days. Frequency of these "storms" is approximately 10 per cent at the present time.

Solar radiation "storms" approximately 1,000 times more severe than the ones described above have been observed five times in the last 20 years.

Some engineers believe there is a good chance that a returned space station orbiting 100 mi above the equator will be protected from all but the most severe solar radiation bands by the Van Allen belts so that little, if any shielding, will be required to protect the crew. If future measurements show that this is not true and shielding is needed, the "shower curtain" approach is the most attractive means of providing it from a weight standpoint.

Shower Curtain

The shower curtain would be a small, heavy-walled sphere with a minimum living space inside to house the crew for up to three days. A return capsule for returning astronauts would be in the Van Allen belts well below the threshold of damage to man-made materials. The space station, its equipment and instruments will be undamaged by even radiation near the earth and the moon, and only the crew will have to be shielded.

Weight estimates for spherical space stations are so high, however, that these a serious doubt about the prospects of packaged space travel in the near future. Space Agency Studies for NASA contractors show that a 50,000 lb. space station at least a 50,000 lb. shower curtain to reduce the radiation from the most dangerous type of relatively low-power solar flares to a safe level for humans. Such a shower curtain would have a spherical living space with approximately 4 ft. radius. It would be quite an engineering accomplishment to provide this cabin with a life support system and external arrangements to keep two or three men also for a week or more during a radiation storm.

The great weight of the shower curtain

would dictate that it serve as many functions as possible in any space vehicle which required it. Depending on the specific vehicle design, the curtain could double as a re-entry capsule and/or as a static structural element supporting dynamics, reducing weight.

NASA studies have shown that craft from the International Space Station will land in heavily with lead and effective radiation attenuation for their weight. Getting away the high energy solar proton and electron rays, and the heat stops the secondary radiation emanating from radiation sources between the curtain and proton. The heavy curtain with an also a fair lead if the curtain must also serve as a recovery capsule.

Radiation Hazards

Space engineers responsible for human protection in the lower Van Allen belt and during a normal solar radiation storm would do the curtain described above. It will not be possible to conduct sounding vehicles with such components into space until very large nuclear reactors are available.

The main encouraging aspect of the radiation picture is the fact that the present data is incomplete and an some areas contradicted. Much experts in the field believe that the most important and useful leads in space will change considerably as more measurements are made. There seems to be no agreement, however, as to whether the

change will be favorable for manned space flight.

The uncertainty of radiation conditions increases enormously beyond the Van Allen belts. Data returned from this area by satellites varies by several orders of magnitude according to the level of instrument used.

Some initial portions of this data are that unshielded rats would die in just radiative dose in two to three weeks, and others show that during an exposure of a year the rats would recover only one half of the aliveable dose.

Pessimistic View

If the pessimistic view proves correct, the total radiation level during a major solar flare would exceed the vehicle protection levels of the present, beyond present knowledge and interests.

Establishing the feasibility of manned flight to the moon within the next couple of decades appears to depend on a more definite knowledge of this area, better shielding materials and designs and/or an accurate method of predicting solar flares.

Information on the occurrence of meteorites in space is sketchy, but based on available information of NASA's Langley Research Center have estimated that a 40-ft. diameter, teardrop-shaped space station in a low orbit around the earth would be punctured at the rate of about once a month. The

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Power Unit Would Generate 300 kw. for Year

Two-loop nuclear power conversion system uses a vibrated vapor Rankine cycle with output of 300 kw for one year in orbit at Geostationary Orbit altitude. Radiation endures a nuclear heat source, surface and generator. System is being developed in part of Project Star, which is under management of WADD and the Atomic Energy Commission. Estimated output is expected to reach 2 megawatts.

Joint would average one-eighth inch in diameter.

Theories on the effect of these perturbations of a space vehicle's structural materials vary widely. One idea is that at very high impact velocities a small object will hit with explosive force and make a crater and cause damage similar to that inflicted by a much larger object traveling at a much slower speed. Gaseous atmospheric penetration vehicles is known to have been caused by high-speed projectiles. Other concepts relate this theory in the case of gaseous collision and some of the materials being considered for its structure.

Rousselle Differences

It appears to be impossible to summarize these theoretical differences without improved experimental facilities on the ground or operable interplanetary satellites. Current high-velocity "gun" used for these tests has limited to a speed of about 20,000 ft per second. It appears mostly the speed of sound in terms of the materials of interest. It is believed that the behavior of entering and impacting changes radically when the impact velocity exceeds the speed of sound in the material.

NASA's Research Advisory Committee for Structural Design has given a high priority to the development of an improved high-velocity "gun" and to

the launching of a satellite which will catch some meteorites and return them to earth so their exact composition can be determined. These activities are believed to be essential to the development of reliable self-repairing and non-explosive space vehicle structure.

Total Environment

Solar ionizing radiation and micrometeoroids are the major influences on the space environment, but there are other factors which will require extensive study and experimentation before they can be described properly in a detailed engineering specification. These factors include:

- **Fluid vacuum**, which has a little understood deteriorating effect on the surface of most materials. In combination with certain types of radiation, a sputtering layer forms on the surface of some materials that rapidly erodes them. When plasma density is high enough, other metals will become welded together. Thermal resistance across joints is markedly different in a vacuum than it is in the atmosphere, causing thermal stresses in structures. This type of problem probably will be experienced in space because the damping action of the atmosphere will be absent to control vibration.
- **Thermal radiation** which will be experienced by a space vehicle is not well understood, even though the character

Sputnik Rocket Down

Washington—Final stage of the Soviet rocket that launched Sputnik IV satellite last May 17 burned up in the earth's atmosphere over the Pacific Ocean on July 17, National Space Surveillance Center reported.

Sputnik IV itself and several other objects still are in orbit with ranges varying from 418.7 mi down to 231 mi and periods ranging from 171.2 hr to 171 hr. Periods range from 91.9 min to 94.9 min. The orbital separation booster parts when known tend to re-enter the upper form of enhanced nose cone (AW 7/18 p. 39).

and effects of solar electromagnetic radiation has been clearly established. The heating of a space vehicle will depend on the effects of galactic radiation and the terrestrial energy from the sun which also has an effect on the space vehicle's environment and these factors currently are not well understood today.

- **Magnetic fields**, atmospheric and radiation fields surrounding other planets will have to be studied in detail before man can hope to travel in them.
- **Landing operations** on the moon and the numerous planets have to be carefully established before the current long-range goal of the national space effort leading man to the next planet—Mars can be accomplished.

Short Range Goal

One of the major short range goals of NASA is to completely define the environment of the early years of space between the earth and Mars and Venus.

This is being done primarily through the research努力 being performed by using instrumentation in payback fashion. A payback period is a time interval over which a system accumulates a new extra pounds.

Some aspects of third generation space vehicle design are clear, even though their environment and design requirements are not fully known. One of the main features of these vehicles from a structural engineer's point of view is the need to satisfy aerodynamic requirements for each a short period of time like this. The cladding must withstand high aerodynamic forces and dynamic loads during launch, and there is no real answer to this requirement except to build a dense, small frontal area structure which will not generate much lift. After this period, however, when the vehicle is in space, the structure must be in an aerodynamic condition to shape it as it passes and to arrange the heavy equipment on the vehicle so that it makes the best use of geometric and construction materials. Thus the

work being done at present, it appears that the focus is for the structures more than third generation, large, complex space structures will be flown and refitted in comparison with modern aircraft.

The conflicting requirements of launch and during operation in space have led man to two extremes to the space vehicle designer. They are to use:

- **Detachable or collapsible structures** which can be deployed onto a small volume, clean, launch and then expanded to the volume of space.
- **Modular components** so that a module could be sent into space in more sections and assembled in orbit. Booster propellant tanks have been suggested as building blocks for such vehicles.

Relative Attractiveness

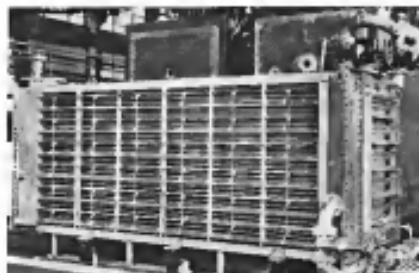
Relative attractiveness of these approaches depends on the weight of the vehicle, cost of assembly, reliability and cost. Current concern seems to be heading toward collapsible structures because a booster craft capable to carry men should be durable enough to risk a huge expensive

space vehicle. As booster payload capacity reaches 15 ton and more, it becomes possible to think of sending complete space vehicles up in a single flight.

Construction Approaches

Importance of strong structural weight on space vehicles and the lack of available materials and joining techniques are the two main reasons for the present geometric shapes. A sphere is the most efficient shape since the weight standpoint for a given vessel of given volume, construction material and internal pressure. A cylinder at twice its 1.5 times heavier than the sphere, and the weight goes up as the geometry is changed to accommodate an special vehicle design requirements.

If space vehicles are made of the high density materials common to aircraft, the weight will be reduced by 50 percent. The basic production aluminum alloy can be modified seriously. However, the broad range of work with new structural materials and new thinking on the part of structural engineers has opened many



Portable Nuclear Powerplant Condenser Tested

Equipment for a prototype model of a portable nuclear powerplant is being built by Westinghouse Electric Corp. The nuclear powerplant is being developed by the Martin Co.'s Nuclear Division for Atomic Energy Commission. Photo shows the condenser of a intermediate E.H. x 3.5 H. x 20 ft. long. Westinghouse has completed a feasible model of a steam generator and secondary loop for the powerplant, and now is building the intermediate, steam generator, nuclear generator and moderator. The Martin powerplant is designed for use in remote military installations. Westinghouse designed the condenser to operate from -60°F to +125°F. The three-phase, 60-cycle generator, which will power sensitive electronic equipment, will develop 1,100 v with 0.95% variation and ±0.2% frequency fluctuation under steady-state conditions. The system can be packaged in pods for possible mobile transport.



Smack Fired From Mobile Launcher

USAF Northrop Stock intercontinental missile is fired from its mobile launcher at Cape Canaveral Missile Test Annex, Fla. Evident from the exploded 340,000 lb. thrust of the booster rocket is deflected away from the launcher towing vehicle by raised rocket nozzles.



Chamber to Simulate Hypersonic Flight Environment

Environmental chamber for hypersonic aircraft being built by Boeing Airplane Co. will simulate the noise, light, vibration, temperature and humidity pressure changes, and changes in the compositions of gases which are expected to be experienced in hypersonic flight. Subject at left is about to be bolted into a small altitude chamber within a larger chamber. He will be given tasks in spotting targets on radar screens, handling simulated controls.

new possibilities in space vehicle design. One of these new ideas concerns "negative" structures which consist of the use of materials that contract in only one direction. With normal solid type pressure vessel construction, the internal constraints are so enormous that once the material should be stressed equally in two directions it is no longer able to give maximum efficiency.

New Materials

New composite materials which come in a form in only one direction have been developed for space applications. These materials have a low strength binder material reinforced with thin wires, whiskers and filaments. Very thin gauge metal elements have been found to have several times the allowable stress in the same metal rolled into a much smaller sheet. Objectives with the

structural specialists at NASA and aerospace experts that the most important advances in space vehicle construction will come through judicious combination of new materials and new design concepts. This has proven true in areas outside other than monolithic pressure vessel design. Some of the major problems which are being studied include clear acceptance by operators and materials engineers are the following:

- Development of improved strength and modulus materials and designs for cryogenic tanks
- Development of methods for stretching panel loads to large volume, thus will promote vessels
- Development of new configurations of low density monolithic structural materials from commercially available pipes or wire material
- Development of improved means of stopping cracks in thin gage pressure vessels
- Development of multi-walled pressure vessels capable of withstanding very high speed impact from small projectiles

Japanese Launch First Kappa Rocket

Tokyo-First Kappa No. 8 hypersonic rocket, carrying a 22 lb payload, was successfully launched last month by Tokyo University's Institute of Industrial Science at Michiohama Beach, about 150 mi northeast of here.

The 35 ft rocket, weighing about 3,800 lb, reached an altitude of nearly 70 mi. Instruments recovered indicated that the rocket had exceeded all aspects of the rocket's bid for. Power plant produced about 120,000 lb thrust.

The launch marked the first time a Japanese rocket reached the atmosphere after 69 similar tests since July 1957. It was one of Japan's International Classifered Test projects. Second Kappa No. 8 flight will measure electron densities in the ionosphere.

Hypervelocity Tunnel To Test Dyna-Soar

Seattle, Wash.—A hypervelocity wind tunnel designed to participate in the development of Boeing's Dyna-Soar manned space glider and McDonnell X-21B programs has begun operation here.

Operating in the speed range from Mach 10 to Mach 27, at temperatures up to 14,000°F and simulating altitude conditions up to 250,000 ft., the electrical and airframe wind tunnel will provide a research capability in regimes of space vehicle orbital speeds.

8-ft-dia tunnel test tube nozzle's



BOEING HYPERSOC hypervelocity wind tunnel has two large circular windows on either side of its 46-in test section. Visible test tube is about three diameters.

test section measures 44 in. in diameter. A variable air-airflow system provides the tunnel, which delivers energy for delivering air impulse equivalent to 5 million lbs of liquid air stored in 2,200 expansion tanks. Centrifugal fans link each compressor to a collector wheel to bring individual charges into a single conductor leading from the zone into which we conduct at the optimum end of the tunnel.

The standard test air chamber is

Space Particle Studies

Durham, Calif.—A hypervelocity impact gun has been developed by Aero-Space Laboratories of North American Aviation's Manned Devices to propel particles at a speed of 10,000 fpm. Set events participating in the program will move more than 40% of the particle mass of the system has been utilized and that greater speeds will be achieved when full available energies of the gun are used.

These experiments are being conducted under an Army Ordnance contract. Purpose of the program is to determine the effects of interplanetary particle impact on spacecraft and satellites, and to learn what would be used most effectively for use of these vehicles (AW July 6, p. 12).



MACH 14 airfoil blower has a total air flow and gross weight around pressure and heat transfer coefficient model.

Variable in use is the use of impact guns. Prior to a tunnel run, the chamber is charged with an initial pressure to 2,000 psi, while the pressure in the test section is pumped down almost to a vacuum. The test section and the air chamber are separated by a roughened capsule. Mach number of the flow is controlled by varying the size of the hole through which the air passes from 1/32-in. to 1-in. At these pressures, the air pressure differential between the test section and the tunnel



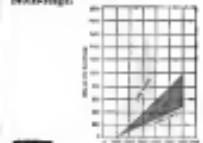
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First Firing of Mace From Hardened Shelter

USAF Martin TM-708 Mace nuclear missile is launched from underground hardened test site at Cape Canaveral, Fla., on the first test of the concrete shelter and the first test in our production type ground support equipment. In field use, however, will be better ground, multiple-well conditions. Mace was fired after a "hot build," in which most of the extensive checkout and assembly processes are completed and missile is held in a ready

condition, with only a brief final ascent needed for rapid insertion. Mace is already painted and is designed to remain in hot builds for months or several days. New integrated missile checkout system, designed by Martin, was used. Testfiring site at Canaveral is equipped to fire two missiles. Launching was the 14th for Mace II and the eighth since test progress moved to Florida from Holloman AFB, N.M.



Robot Designed For Missile Retrieval

Washington—Vitreo Laboratories is assembling a Solaris underwater robot system designed for remote retrieval and ocean research. The system is scheduled for delivery to the Navy in October.

Initial Solaris trials will be used to explore topography at the Rappahannock River, test range, but Vitreo sees the greatest potential for the system is in salvaging space rocket capsules, debris and recovery of new items. Solaris can pack up 1,000 lb and perform a variety of salvaging and observation missions.

Vitreo now is assembling Solaris under a \$140,000 contract awarded last September. Complete system weight 500 lb and will hold under a surface step at depths to 2,000 ft. Supported by half-track wire rope, it will sail 15 kn deep's presence to pursue its payload area, sonar, television camera. Control messages on the ship has references to time, depth and direction indicators.

New version will use salvaging gear manipulated by console operator. The working arrangement could be explored by cable class, wire gear, explosive bags, ion charge, magnet, supply or missile launch.

Eight reduction manner is measured as a pressurized housing surrounded by an array of thermal sensors. Depth range would be greater than current maximum of 50 ft. In pressurized, a timer will be limited by high resolution flow transducers using an eleven stage profile.

The last option above class features a 500 volt, 16 hp, solenoid control driving two variable pitch propellers through a gear train. Gear box can be varied to a float range from 210 lbs positive to 300 lbs negative. While propeller is set to rotate at constant 40 rpm, pitch varies from 0° to 90° relative to frame in 1.7°/sec. travel time. Reversal is 90°/sec. in high, 33°/sec. wide lift and 63° in long.

In addition to nozzle, nose cone and torque arm, Vitreo can Solaris can be used to retrieve underwater cables and sample ocean bottom.

Although the smaller, heavier launching system from Atlantic Marine Research has largely superseded conventional Solaris, Vitreo expects a lot. Vitreo also envisions research in soft bottom by use difficult physical problems.

Convair Given Additional Contract for Army Mauler

Convair Division of General Dynamics has received an additional contract for \$8,176,000 from the Army for continued development of the Mauler battlefield air defense missile system. Work on the program is being done at Convair's Fort Worth Division.

Steerable gunner in this 12" O.D. disc section features Drive-Gear assembly mounted before entrance and bearing ring. Both spikes and pins are ground and held to 0.001" accuracy after hardening the entire gear.

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and different outside
diameters. Back
page for details.



More machining operations on this
Gear Gear Shaft has performed short
localized hardening with the cold
area in Rockwell C42. External spline
and gear teeth are ground with splines
held to precision tolerances.



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100% Polyester Film. Density 0.96 gm/cm³.
Thickness 0.0015 in. Tensile Strength 10,000
lb/inch. Elongation and Modulus: Dynamic, 1000
lb/inch. Dynamic Modulus: 100,000 lb/inch.
Tensile Strength: 10,000 lb/inch. Tensile Modulus:
100,000 lb/inch. Density: 0.96 gm/cm³.
PVC 100%.



Concrete Cover Aids Radiation Tests

Molded concrete blocks, weighing 1,190,000 lb., help to shield radiation effects test in a pair of nuclear reactors at Convair Division of General Dynamics Corp., Ft. Worth, Tex. The cover prevents gamma rays and neutrons produced in the underground reactor from mixing with those from nearby aircraft shield test reactors.

Gulfstream Cleared For Weight Increase

New York—Gulfstream Aircraft Eng-

assing Corp. has obtained Federal Aviation Agency's airworthiness certificate for increasing maximum allowable weight in its Gulfstream twin-turboprop executive transports by 1,580 lb.

Gulfstream owners, Gulfstream In-
c., may begin operating the trans-
port at 35,100 lb., instead of the pre-
vious 33,600 lb. "We thin believe,"
Replacement of an hydraulic pump in the
plane's landing gear is the only modifi-
cation required.

The increased weight increase will be
accompanied by a 1,680 lb. loss in
the Gulfstream's maximum loading
weight, which will run from 32,500
to 31,600 lb. Since fuel weight of 21,
500 lb. will remain unchanged,

The plane's maximum payload of
4,150 lb. (the difference between maxi-
mum max load weight and operating weight)
will be increased to 6,070 lb.

Gulfstream also may offer certification

of two 190 gal dispensing fuel tanks
outboard of the Gulfstream's wings.
But the modification, which would
greatly increase the aircraft's operational
capacity, will not include only a
passenger cabin expansion.

As of July 1, of the 45 Gulfstreams delivered by Gulfstream, 37 had been placed in operation by their purchasers.

The lighter gross weight addition is of
major significance to Gulfstream owners
because it doubles the plane's passenger
capacity and increases the plane's

carrying capacity on long-range missions.
Operating under the original gross
weight, the Gulfstream, with a full fuel
load of about 10,100 lb., had a top
payload of approximately 1,160 lb.

The squared above are passengers.



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Republic's F-105 Thunderchief, the Air Force's new Mach 2 jet fighter, is able to nail targets on the land, night or day, cloudy or clear—even if the targets are hidden deep in rugged mountainous terrain.

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tions for both low-level and high-level missions... for search, automatic tracking, air-to-ground ranging, ground mapping and terrain avoidance.

For more than a decade Autonetics has pioneered the way with monopulse radar systems like SABRE to provide America's pilots with a sixth sense.

Autonetics 

A Division of North American Aviation Inc. • Downey, California



Sabena's First Caravelle VI Assembled

First of Sabena's four Caravelle VI's, seen in the workshop of first Aviation at Toulouse-Saint-Martin, is assembled in three sections. When its arduous tour of the 70 passengers are off, which comes at 800 km/hr.

average an average passenger weight of 163 lb plus 40 lb of baggage. At its new gross weight, the Caravelle can carry full fuel and up to 12 passengers, depending upon the interior configuration of the aircraft.

According to Grammont, the average four configuration passenger seats for about 10 passengers, while the average Caravelle flight carries 5-7 passengers.

PRODUCTION BRIEFING

General Dynamics of Canada, Deux-Montagnes, Que., has started a program to produce selected D-551 aircraft to replace their own production of experimental aircrafts. The Canadian aircraft board is proto-type aircraft, will go East to Industrial Products Division of ITT, Six Flags, Conn., and Bechtel Pacific, North Hollywood, Calif.

Sikorsky Aircraft, Stratford, Conn., will receive 32 Army H-17 helicopters under \$5.5 million contract from the Army Transportation Material Command. Delivered by the Sikorsky helicopter division include installing automatic steering equipment and improving its aerodynamic efficiency.

Dole Corp., New York, N.Y., will produce two Dole meat flight centers after subcontract from the Navy under \$14,000,000 contract. The two centers, the second and third purchased by the Navy, will be attached to jet aircraft meat trucks in Corpus Christi, Texas, and Memphis, Calif., Naval Air Station.

Institute of the Aeronautical Sciences (IAS) has voted to drop "Aeronautics" in the title and substitute "Aerospace," pending membership approval.

Leybold's fuel injection engine for use in the Aero Commander 500C aircraft, twin engined designation 10-540, has been certified. The engine, rated at 200 hp by Federal Aviation Agency, Commander Model 500A, is powered by two 200 hp IO-379 power plants (see p. 146). New engine is a three-stage, air-cooled model; company will have a general and a super charged version available soon.

Royal Air Force has ordered 20 additional Armstrong Whitworth AWP 660 transport aircraft, including 10 sets of AW 660-100 aircraft, worth \$7.5 million. The AW 660-100 version of the Armstrong Whitworth aircraft will make its first flight later this month. Armstrong Whitworth also confirmed that Rediff's Aeroflot will take delivery of five Argosy C aircraft, the first flight due next year although the contract has not yet been signed. These aircraft will be used to fulfill Rediff's part of the Logos contract (AW 744, p. 40). Loading systems and spares arrangements are under negotiation.

California Institute of Technology's Jet Propulsion Laboratory has closed an air traffic contract with White Sands Missile Range, N.M. The 19 people employed at JPL at the range have been loaned to JPL in Pasadena or to the JPL facility at Altitude Missile Range, Cape Canaveral, Fla.



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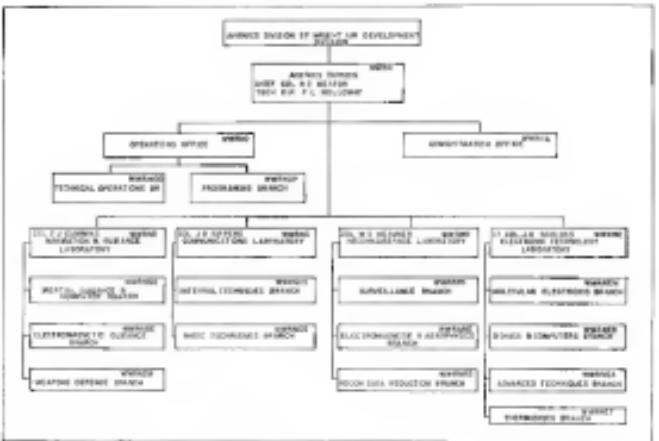
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AVIONICS



AVIONICS DIVISION, Wright Air Development Division, responsible for applied research, is divided into four major laboratories.

WADD Avionics Division Aims at Space

By Philip J. Kline

DAYTON, Ohio—Newly formed Avionics Division of the Wright Air Development Division hopes to obtain nearly \$50 million in fiscal 1961 funds for applied research programs, the bulk of which will go to projects which are intended toward space.

The Avionics Division, headed by Col R. D. Kotter, one of last divisions to be the Directorate of Advanced Technology, is responsible for applied research in distinguished from basic development for specific weapon systems. The latter is the responsibility of the newly formed Directorate of Systems Engineering (AWAR No. 9, P. 2).

How, though, is how the fiscal 1961 funds are expected to be divided among the Avionics Division's four laboratories:

- 15% Navigation & Guidance Laboratory
- 15% Reconnaissance Laboratory
- 30% Electronic Technology Laboratory
- 30% Communications Laboratory.

There are approximately 450 personnel now employed in the Avionics Division, of whom about 75% are engineers and scientists.

The majority of the former laboratories have been reorganized into two major basic research activities into two main fields: basic applied research, hereinafter called basic research, and the other, hereinafter called basic development, under the direction of a new directorate, the Directorate of Systems Engineering Directorate, which is responsible for many laboratories, for reconnaissance systems, for navigation systems, for weapons, etc. Only time will tell whether this measure is justified or whether recent events have given reconnaissance sufficient attention.

Unresolved questions over the Air Force's future mission in space, coupled with the fact that traditional weapons and munitions are in a state of flux, make it extremely difficult for many laboratories in the Directorate of Advanced Technology to plan their future programs.

Until somewhat more clarity is reached in some of the other laboratories. For instance, there is no one who can determine what reconnaissance systems must fulfill in priority and emphasis because of the new setup. Because Air Force has no vehicles, except for the Strategic

Bureau applied research unit work for 10 years ahead of hardware development, many of the laboratories must direct their efforts onto "Black Bag" type projects.

The Avionics Division's Navigation & Guidance Laboratory, for example, which has been working on the problem of maximized space station optical attempts to destroy them after they orbit the earth, when reported down the earth which acts as a practical limit to the definition of earth-based objects that can be obtained from a reconnaissance satellite. One objective of this program is to establish practical limits for the size of satellite optics consistent with launching imposed by atmospheric factors.

Since the U.S. is only starting to develop satellite interception detection techniques, and the Soviets probably are in a similar stage, it will take time to attempt to develop techniques for intercepting or destroying space warships which themselves are only in the final testing stage.

However, there are certain bases which apply to any interception problem. For example, the surface/space vehicle intercept problem will not arise until the refined hearing devices at the early developmental stages of an aerospace vehicle are developed. For an aerospace vehicle, communications equipment which can be folded during launch and unfolded once vehicle is in orbit. Other systems research must include designs for use in hypersonic vehicles where survival and radiation forces as integral part of the vehicle structure and which employ electronic sensing techniques.

Developing new techniques for orbital guidance components and star tracking, specifically suited for space vehicle use, also are of interest in the Laboratories, according to Col. T. J. Curran, chief of the Navigation & Guidance Laboratory.

The bulk of that Laboratory's effort is aimed at space applications, except in the field of electronic counter measures where it will support applied research for intercepting vehicles.

Reconnaissance Laboratory

The Reconnaissance Laboratory, under Col. W. S. Hartman, has been assigned the design and development of remote detection and identification of objects in space from both intercepting and space vehicles, as well as surveillance of objects on the earth. The Laboratory plans an intensive program of applied research in sensors suitable for detection and reconnaissance, ranging from the ultraviolet and visible light end of the spectrum through infrared and radio/radar bands.

For example, map effect is intended to produce infrared detection with ground stations set out in the shape of a grid covering the entire 360 degrees, where radio/space cold objects have three per cent reduced radiation, for use in detecting objects in space. Ultraviolet de-

tectors also will sense incoming effect. The Laboratory regards the Ballistic Missile Defense's WS-117L Mafia and Seven satellite programs for example, one such current program is intended to investigate the "disarming" problem by the earth's atmosphere, a problem which may be solved by intercepting when reported down the earth which acts as a practical limit to the definition of earth-based objects that can be obtained from a reconnaissance satellite.

Because conventional photographic film emulsions either fade or are damaged by radiation from the Van Allen belt, or from nuclear explosion, the Laboratory is sponsoring work on other types of photographic recording media, such as the recently announced General Electric thermal plastic recording (AWAR No. 8, p. 87). A number of concepts are being evaluated, including a proposal to the Col. H. H. Hartman, chief of the Reconnaissance Laboratory.

Microelectronic devices will represent major program areas for an Electronic Technology Laboratory, headed by Col. J. C. Schles. Although interest is focused by the man, weight, power and reliability requirements of space microelectronics and sensors, programs are expected to pin off soon the board, finding application in ground-based and airborne systems as well as in space.

Fiscal 1961 funds will be used to support development of advanced microelectronic functional electronic blocks, called FEIBs (pronounced "feeb"), based from study development by Westinghouse and Texas Instruments under WADD sponsorship. Laboratories also plan to put funds into



Reconnaissance Antennas Mounted on T-29B

Wingspan first-source antenna, for electromagnetic reconnaissance, or new drugs analysis collection by means of International Telephone & Telegraph Corp. aboard the Air Force T-29B. Wright brothers provide full 360-degree coverage without blind spots.



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Furthermore, a radical advance in aerial reconnaissance techniques makes it possible to transmit visual information from aircraft or uncrewed aircraft to ground receivers in seconds, without having to land.

The high performance of CBS Laboratories Photoscans is illustrated above. On the left is an enlarged portion of the original aerial photo which covered an area of forty-four square miles. On the right is a portion of the reconstructed picture after transmission through the Photoscans System.

Class-leading career opportunities are available at CBS Laboratories on long-range systems development programs such as Photoscans. Positions for physicists and electrical engineers are now open in the following departments: Military and Industrial Systems, Acoustics and Magnetism, Solid State Physics, and Vacuum Tube Physics.

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the development of techniques for recovering encoded PELs. Without a complete understanding both unique, much of the size and weight saving of multistage construction is lost.

Laboratory has study contracts now in the field of hearing. Fiscal 1965 funds probably will be used for further studies aimed at obtaining mathematical expressions which describe the operation of certain animal functions, then attempting to translate these into electronic equivalents, according to H. V. Kiddle, technical director of the laboratory.

Because of the close interrelation of computer logic design and the capture of the logic elements used in the construction of a computer, the Electronics Technology Laboratory is expanding its efforts to include applied research in logic computer components and circuit logic, according to Col. Schlimm.

Another infrared area is basic research into planes and its relation with radio frequency energy used at distances, high power generation for atmospheric winds. Laboratory also plans to carry out investigations in space-aerodynamics and electronic applications for new materials. Ballistic missile financial support is planned for conventional weapons research because of current weapons-financed programs supported by congressional appropriations.

Communications Laboratory

The responsibilities of the Communications Laboratory, headed by Col. F. R. Rapier, encompass reflecto-ground, vehicle-to-vehicle, and aerial vehicles. The laboratory is also involved in advanced telemetry techniques. One of the more active programs now under way is to explore the use of modulated light for communications between the satellite and for reflecto-ground use (AW Dec. 16, 1958, p. 87).

There is also an ongoing effort during the coming year to develop compactness to reduce the power/heaviness required for satellite voice communications. This is particularly important for space vehicles, since solar cell technology is available. Laboratory programs also will aim at improved receiver sensitivity and lower noise figure.

Programs to investigate techniques which will enable an aircraft to simultaneously transmit on a number of different frequencies is at present far Fiscal 1965, according to Lt. Col. Robert A. McPherson, assistant chief of the Laboratory. Communications Laboratory also has programs to develop small satellite radio communications equipment which will permit direct communication between man-made objects of an aircraft's payload without retransmission of received wave information.

FILTER CENTER

► Transmitting Waves May Be Filtered

Scientists in the world suggest that several ways may be found for applying the filtering process which will filter the radio. One reduction is the risk of price cutting as transmitter. Another is the fact that transmitter sales for April were up only 60% over previous year. This is a remarkable increase but for the fact that the semiconductor industry and sales have been declining each year. Situation results from failure of many companies to cut costs, and major factors are the older manufacturers and the fact that fewer Defense Department dollars go into large-scale production programs. Japanese semiconductor industry also reportedly is showing over growing increases of transistors.

► Michigan Study Molecular Trends
Michigan will study aerospace materials to determine future requirements for materials in aircraft and in space. Wright Air Development Division is involved. Georgia will study ex-

isting and proposed equipments to determine frequency, distribution, similarities and characteristics of equipments and circuit functions.

► Galactic Noise Novelties Standard Electronics Corp., El Segundo, Calif., will measure spectral characteristics of 30 radio sources to obtain data from galactic radio sources to explore its possibilities for radio navigation and guidance under \$35,000 contract from Wright Air Development Division.

► GE Design Welded-Wire Matrix Machines-Machines which can fabricate welded-wire mesh structures (AW Apr. 24, 1959, p. 134) under contract of large program prepared internally by company, is being developed by General Electric's Light Metal Electro-Debt Department. The machine, slated to be ready in September, will be able to produce 10 ft. of welded-wire mesh ribbon per hour. Plans call for design optimum mesh to cost, and machine to produce it. GE estimates that it will eventually be able to make welded-wire mesh up to 40 ft. long after recent design has been fixed. Late tests on existing machine establish,



Librascope Develops New Potting Technique

New potting and protection materials techniques for complete electronic assemblies, developed by Librascope Division of General Precision Inc., are shown here applied to the printed circuit board, called "logic card," which comprises the intelligence of electronic digital computers. Plastic protects against humidity contamination, shock, vibration

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MANAGEMENT

Marquardt Plans to Diversify to Survive

By Michael Yester

Columbus, Ohio—Faced with the approaching completion of the Booster engine program, Marquardt Corp. is fighting for corporate survival by aggressive moves into the electronics and space fields to tide over the critical years.

This is the view of Roy E. Marquardt, corporation president, who told *AVIATION WEEK* his company has a number of ongoing projects under study but added "the big question is whether we'll have time to bring them to fruition."

The alternative, which Marquardt apparently is attempting to avoid as long as possible, is selling the company to one of the defense or engine firms that have been looking over its corporate door.

Marquardt took an aggressive case of the booster's role in programs during the next decade and beyond. He stressed that, even in the company's aerospace future, Marquardt's potential as a large space booster was not at a mere "conceptual" level, as was defense only ICBM missile, and the company's new nitrogen-burning ramjet that might be developed for use in Mars.

In a dimension of Marquardt's present plans and problems, Marquardt said the next few years absolutely are going to be critical ones in the life of the corporation.

Essentially, Marquardt's problem now is the same one that has been plaguing the company almost from its inception: that of filling an ever-expanding gap left by the cancellation or completion of the company's major project—the Booster missile engine. Starting off in a small way, Marquardt has been working earnestly to find a new program companion so far, each time Marquardt's present program has ended, its place has been taken by a somewhat bigger program.

Diversification Moves

At the same time, the potential of financial disaster has loomed ever larger and more threatening if that gap was not filled. Thus, as the number of government programs grows smaller and each program becomes increasingly larger and more complex, it is more difficult for a comparatively small independent company such as Marquardt to get one of these projects. Given the time, Marquardt hopes to remedy this situation by further diversification into the elec-

tronics and the consumer market. At the least of Marquardt's current difficulties is the pending loss of the Booster engine program which is scheduled to end production in the second half of 1982. This has been and still is the company's most important project.

This year, Marquardt's Ogden, Utah, plant has engaged in a major changeover effort, phasing out production of the Booster-A model and phasing in the B model. It also has started taking on a new line of work. The company also has been heavily occupied with the development of an advanced, two-chamber Booster. For this work is now being completed, and, at least it now appears, there will be no more Boosters after 1982.

As for the ramjets announced by the Bonneville in the early part of this flight development program, Marquardt feels full responsibility. At least some of the first few flight vehicles were due to modifications in the company's original ramjet design. Marquardt and Marquardt also rendered many services to North American Aviation's Columbus Division as the major supplier of the flight software and Ramjetane dual altitude data (AWW July 4, p. 35). That same ramjet engine will be used in both versions of the device. It will be a new engine, considerably smaller than the Booster powerplants. Marquardt considers it a good program but not big enough to support itself to fill the muscle gap that will be left by the phasing out of the Booster project.

Electronics Venture

Marquardt's venture into electronics now is beginning to pay off and may help carry the company over the next few critical years. This year electronics will account for an estimated 10% of sales, but just just recently it has looked as though it were going to prove to be more than a 10% share. When the company's longer-term Market and Product's manager simulator activity a year and a half ago, it was losing money, according to Marquardt. The company continued a painful battle to keep the line in the development of the T-4 simulator for as long as training as defense could command personnel. However, this trouble now is behind it. Marquardt said, and the company has just received a major new contract for simulation to train aircraft personnel in the launching of Hubble Dog and Quill missiles. There also are two other major

training simulator programs that the company hopes to obtain in the next month or two.

For the commercial market, Marquardt is doing a variety of work on a privatization and test equipment. Most of this work, however, is still in the development stage. The only equipment the company is currently selling now is a high-temperature materials test unit. But even taken as a whole, Marquardt considers the potential of the company's current electronic activities comparable, limited.

Yester spoke with great concern, as did Marquardt in answering an *AVW* query (AWW June 20, p. 106). If these programs were to lead to a success story, it could strongly bolster the market for survival and a replacement for Boosters. The subscale-powered ramjet still presents some formidable development problems, including materials, says Marquardt. But he is confident that these will be overcome.

Ramjet Ramga

The ramjet-powered ramjet engine, Marquardt believes, is potentially an attractive way of propelling a missile with a low cost at high supersonic speeds and low altitude. It holds the promise of solid range, maneuverability and the possibility of refuel. In combination with an ICBM boost, he says, it makes a good offensive system that could form the engine into an intermediate and early development of an offensive system. Beyond the weapons applications, Marquardt sees the possibility of the ramjet being used for space transports. The transportation of humans by this means does not appear attractive due to the shielding problem, which would be approximately the same as those anticipated in a nuclear-powered rocket.

For the past few years, Marquardt has been working with Air Force contract support for the development of large space boosters. Of the several approaches to the problem now under study, the one that will not work is about the ramjet. Basically, a characteristic of the ramjet rocket, the impetus is a ramjet engine that can be closed off at one end to function as a rocket when required. Originally, it was considered as a power plant for an advanced Booster that would not have to use boosters to get off the ground. For this reason among others, it has also been suggested for use in a supersonic transport.

In large space booster applications for

such missions as setting up research space stations, according to Marquardt calculations, even the first relatively primitive to perform will use up to 90% of the total new potential for these boosters. Since the ramjet is expected to add only 10% to the total of the estimated cost. The advantage of the impetus as a powerplant for an anti-ICBM weapon lies in its unique cruise capability. Compared with an adequate early warning capability, it is suggested, this would enable the missile to cruise out to the site of anticipated ICBM penetration where it would convert to a nuclear warhead at its attack. Some aerospace companies reportedly had used the hypersonic engine as the basis for proposals for area defense anti-ICBM systems to supplement the point defense Nike Zeus.

Hybrid Engine

On its own, Marquardt is working on the development of a hybrid (solid fuel) liquid oxidizer rocket engine primarily for ballistic missile booster applications. General Control Rocket is supplying the solid fuel grain for this work. Company work to date indicates that such an engine will offer specific impulse at least equivalent to liquid oxygen/kerosene up to 1000 kg-thrust, high reliability, short construction time and good storage characteristics since fuel and oxidizer are stored separately.

Another Marquardt project in P-T-C (position, attitude, temperature-controlled) involves a reentry rocket system to be used in stabilization and control which reportedly achieves unusually high performance efficiency.

From a long-range point of view, one of Marquardt's most interesting projects is in Marquardt's corner which would be able to compete in Man's stratosphere. The company has already done tests. Marquardt said, with one of its research teams finds that a ramjet basic here when combined with nitrogen. Marquardt also is carrying out studies on electrical propulsion techniques based on linear induction, and on the production of thermal power from solar and nuclear energy sources.

Highly Promising

Many of these programs are considered highly promising, but they all require time to reach the payoff. One of the longer and perhaps more uncertain and less much risk Marquardt has has Marquardt wants to see the company keep its corporate identity, bring in students to market and diversify through in-house developments and acquisitions. But Marquardt has stockholders and a board of directors to answer to, and other aerospace companies have been paying Marquardt with a lucrative acquisition proposal.

General Electric and United Air-



Rocketdyne Facility Will Test F-1 Turbopumps

Stand at North America's Rocketdyne Propulsion Field Laboratories, Canoga Park, Calif., will test turbopumps of National Aeronautics and Space Administration's F-1 15 million lb thrust space booster. Two 30,000-gal liquid oxygen tanks, a 10,000-gal fuel tank and a 20,000-gal water tank have been installed on the stand itself. Gas generation exhaust is directed upward through tilted pipes at left, above, and is quenched by ethylbenzene as top of exhaust pipes. Turbopump, to be tested later this year, will deliver 6,000 lb of pressurized air sent into the F-1 combustion chamber. Below, a 10-ton liquid oxygen vessel is being moved to the test stand.





Ballistic and boost-glide flight paths

These flight paths, arcing through space and re-entering the atmosphere, are characteristic of the paths of a ballistic missile and a boost-glide vehicle. In both cases, Boeing holds major contract responsibilities. Boeing is weapon system integrator for the solid-booster tree, Minuteman, and as part of a wide-area missile program, is developing Dyna-Star to study the problems of manned space flight. The Dyna-Star vehicle will be capable of re-entering the atmosphere and making a normal controlled landing.

Boeing maintains and expands, in addition, its advancing the state-of-the-art in many areas: advanced military and commercial aircraft; hypersonic flight; space craft environments; vertical and short take-off and landing aircraft; gas turbine engines; anti-missile warfare systems; among others.

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and's Pratt & Whitney Division were the first groups to express an interest in acquiring the Messier Corp. Last year Thado engaged in merger negotiations with the company. At that time Messier was in the sales annual position of being able to give Thado two things it very much wanted—Rex McQuarrie himself, with the experience and qualifications to succeed Tomislav J. W. Cradick, who wants to retire, and a going nuclear propulsion capability in the present field of reactors and reactors. Offering is 400,000 shares of capital stock for public sale at \$10.00 per share. Proceeds will be used for investment in small business concerns in amounts up to \$100,000 for a single concern.

Negotiations Finally were called off with an official explanation that the two companies couldn't agree on terms of the stock exchange. However, although neither group will officially comment on the matter now, the sell team for the hook in negotiations is believed to have had a "good deal" of success in talking over 100 of his top people along with him into Thado's company's shareholders, already filled with young executives.

The company most recently reported to be showing an interest, though not yet direct, is the aerospace Messier Corp. in Lockheed Aircraft.

Lockheed's planning department, according to informed industry sources, has been engaged in carrying out a study on Messier.

New Offerings

The Garrett Corp., Los Angeles, Calif., engaged in the manufacture of aircraft and mobile component systems. Offering is 100,000 shares of common stock for public sale at \$14.00 per share. Of the proceeds, substantially all will be used to reduce the current bank borrowing.

Infrared Industries, Inc., Williamson, Mo., engaged in the manufacture and sale of infrared detectors for infrared system airborne procurement by the U.S. Armed Forces. Offering is 115,000 shares of common stock for public sale, the offering price and underwriting terms to be supplied by amendment, of the shares, 106,000 to be offered for the account of the company and 15,000 to the hidden seller. Of the proceeds approximately \$430,000 will be applied to the discharge of indebtedness of the company and that of a subsidiary, the company for working capital and other purposes.

The Yantek Electric Corp., New York, N.Y., principally engaged in the development, design, manufacture and sale of electronic power and rechargeable batteries under the trademarks, 885 model and of silver-zinc rechargeable batteries under the trademark Silver 34 living is 214,000 outstanding shares of common stock for public sale by the hidden seller, offering price and underwriting terms to be supplied by amendment.

Aerospace Investing Corp., Washington D.C., a closed-end, nondiversified entrepreneurial investment company to provide equity capital and long-term loans to well-known companies engaged in scientific development, scientific applications and manufacture of chemical and other products as defined in the present field of activities and interests. Offering is 400,000 shares of capital stock for public sale at \$10.00 per share. Proceeds will be used for investment in small business concerns in amounts up to \$100,000 for a single concern.

Vision Associates, Palo Alto, Calif., has three classes of 500 shares of common stock for public sale, the total amount offered is 156,045 shares of capital stock for subscription by stockholders of record July 14, 1969, at the rate of one new class for each 75 shares then held.

Autos, Inc., New York, N.Y., operating under New York law in June, 1968, in August of 1969 of the outstanding stock of AST Co., Inc., and Dataco Industries, Inc., AST Co. is engaged in the business of data processing, including the design, production, installation, maintenance, programming, distribution, sales, flight instruments, electronic computers, personal hall hearings and carry-on telephones equipment and supplies in the electronics, aircraft and space industries. Dataco is the exclusive membership source and supply agency for racing tubes and television picture tubes marketed under the brand name DeMilt. Offering is 100,000 shares of common stock for public sale at \$45.00 per share. Of the proceeds, \$41,000 will be used to pay the first year's cost of the Dataco membership of 41,178 shares of AST common stock to be acquired from Bruce Barbour, \$15,000 to repair a loan from Morris Klein, a director and principal stockholder, \$15,000 to acquire second bank loans to Dataco, \$25,000 to relocate the operations of AST Co., \$10,000 for advertising, \$61,000 will be added to working capital and to be used for corporate purposes.

Assault Dynamics International Corp., New York, N.Y., engaged in the development, design, manufacture and sale of electronic power and rechargeable batteries under the trademarks, 885 model and of silver-zinc rechargeable batteries under the trademark Silver 34 living is 95,000 shares of common stock for public sale at \$15.00 per share, this is the first public offering of common stock. Proceeds will be used to expand inventory and to eliminate a working capital deficit.



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BUSINESS FLYING

Time-Lease Firms Spur Business Travel

By Herbert J. Colemen

Nationwide utilization of time-share business aircraft based to corporations on a guaranteed-one-time basis is being spurred by two new companies which will supply aircraft, pilots and crews.

The firms are Air Time Leasing Division of Aero-Industries, Inc., of Miami, Fla., and Private Air Travel, Inc., of East, Pa. Air Time Leasing has

aircraft owned and 12 on order and Private Air Travel currently is negotiating with other aircraft manufacturers, headed by Alexander Beyer and others, who include Jacobs Aircraft & Engineering Co., engine manufacturers, Aerotek Aviation Corp., which makes aircraft and missile components at Baytown, Tex., Management Enterprises, operator of the Pittsburgh, Pa., airport, and Penn Airways, a scheduled airline.

The Miami firm is the newest operation of the Aero-Industries group, headed by Alexander Beyer and others, which includes Jacobs Aircraft & Engineering Co., engine manufacturers, Aerotek Aviation Corp., which makes aircraft and missile components at Baytown, Tex., Management Enterprises, operator of the Pittsburgh, Pa., airport, and Penn Airways, a scheduled airline.

At Miami, Air Time Leasing now has one Aero Commander, one Piper Apache and four Cessna 172s. In addition, it has an Aero Commander 500Bc and a Cessna 402C as well.

Mr. Beyer, president of the firm, and the company's chairman have signed five firms, including a contractor and the other shareholders. He said Air Time Leasing also intends to run a lease-back operation, in which it will purchase a company's fleet and lease it back on a guaranteed lease basis, factoring the crew and services.

Eventually, Mr. Beyer believes, Air Time Leasing will be fully active in the aircraft leasing field through acquisition of business jets and his plan is to investigate this field.

Florida Concentration

The company also will plan to concentrate operations in the Florida area for the next five months at least, before expanding nationwide. There is considerable interest, Mr. Beyer added, in flight in the Caribbean area. One client, Bluebeam Machinery, has signed up a Cessna 172 and Piper Apache to be based to Florida principally to the Florida market.

Air Time Leasing believes the plane-pilot, maintenance and insurance in the contracting firm, as will Private Air Travel, Inc. Both companies will supply dispatching services. Eventually, Mr. Beyer estimated, Air Time Leasing will add helicopters and larger transports to its fleet. At the moment, the helicopter-type decision has not been made, but Mr. Beyer said, "we have Douglas DC-9s and Lockheed Lodusters in the class of 'large'."

As far as the nationwide operation goes, Mrs. Steward said, she conceived the Air Time Leasing idea and sold it to Aero-Industries, a venture now in underway as a potential buyer. The company, which had one public stock issue, is capitalized at an excess of \$1 million, according to Mrs. Steward.

Air Time Leasing is taking no charter losses "at the moment," but is concentrating its sales efforts on contracts ranging from one to five years. Roughly,

an Aero Commander will cost about \$117 per hour on a 200 hr. guaranteed time year's contract, she explained.

Mr. Steward said, Air Time Leasing will start with a fleet of planes to cost each \$60 to \$100 thousand.

The company is organized in offices leased from American Aviation at Miami International Airport. General manager is L. Clark Beeler, and Charles J. Ross is director of operations. Company name is being changed to fit and expand personnel.

Private Air Travel, Inc., is based at Port Everglades and is headed by Earl E. Keane, who resigned as manager of General Electric's Transoceanic Division after 14 years of service in the field of marine and surface transport computers.

Kane has been negotiations with Birch, Conn., Piper and Monroe to outfit companies or consortiums for an initial Private Air Travel order that could run as high as 100 airplanes.

In effect, Private Air Travel is offering a complementary franchise-type service consisting, as Kane put it, "the more aircrafted planes with often having scheduled airline routes." He said that of about 3,000 public airports, only about 600 have scheduled service. The company has applied for an FAA permit to operate as two service.

He Struck

Organization of Private Air Travel, Inc., is the culmination of an idea that was about 12 years in gestation. Associated with Kane are R. H. Paham, vice president and national sales manager, and David Gafford, legal counsel. Company has no stock offering on the open market.

Private Air Travel currently is setting up its operations in the northeast section of the U. S., gathering leases of aircraft to one thousand small non-corporate users and the results so far, which include no money transactions, are "most encouraging."

The company will start service when contracts signed within a 100 mi radius of a designated airport justify the buying of five airplanes there. Each airport will have its own dispatching service and Private Air Travel is being its own pilot, who must have ATP and instrument ratings.

In addition, Keane said, Private Air Travel plans to have some single engine planes built at the Mooney and Beech plant for the so-called "hobby" pilot who wants to continue for a few years but at lower cost per mile. Computer planes also can be flown by duly qualified pilots on the contract basis, and left at decommission, with Private Air Travel picking the plane up or reselling it from that airport.

Keane cited three advantages to

Civilian Aircraft, Engines Shipments

May 1968

Item	May 1968	Comulative total Jan.-May 1968
Aircraft aircraft, total airframe weight	1,091 lb.	10,919 lb.
By weight of plane:		
Under 2,000 lb. airframe weight	do	207 lb.
2,000 lb. airframe weight and over	do	9,792 lb.
By number of planes:		
1- and 2-place	do	718 lb.
3- and 4-place	do	3,738 lb.
Over 4-places	do	9,473 lb.
By total rated horsepower, all engines		
Under 100 hp	do	417 lb.
100-300 hp	do	2,160 lb.
300 hp. and over	do	8,720 lb.
Aircraft engines:		
Rotary-wing	Number	lb.
Gas turbine	do	194
Gas turbine	do	101
Complete aircraft	Number	lb.
By weight of plane:		
Under 2,000 lb. airframe weight	do	116 lb.
2,000 lb. airframe weight and over	do	985 lb.
By number of planes:		
1- and 2-place	do	374
3- and 4-place	do	2,730
Over 4-places	do	507
By total rated horsepower, all engines:		
Under 100 hp	do	427
100-300 hp	do	2,055
300 hp. and over	do	6,608
Value of shipments of complete aircraft and parts, total	\$1,000	14,779
Aircraft, total	do	132,447
Under 2,000 lb. airframe weight	do	14,194
2,000 lb. airframe weight and over	do	121,253
Aircraft parts	do	10,446
Value of shipments of aircraft engines and parts, total	\$4,454	70,933
Aircraft engines:		
Rotary-wing	do	2,044
Gas turbine	do	181
Gasoline	do	52,108
Ballistic engines (planes) 2,000 lb. airframe weight and over	Number	do

* Revised.

** Replaced by civil aircraft engine for individual companies.

Source: Bureau of the Census, Industry Division



Umbaugh-18 Flies With New V-Tail

First flight photo of the Umbaugh-18 prototype shows configuration with new V-tail instead, which company says aids in stability. Initial production of Fairchild Engine & Airplane Corp.'s Umbaugh plane (AVW June 27) is 100. Previous photo was of sleeker-type single-seated aircraft and different-type tail with their vertical stabilizers. Aircraft is not yet certificated, but Vista models have rolled out.



WING TIPS



DON'T BE A CLOUD CHASER. Flying too close to Old Man Clouds is leading to air collision. If another plane levels through the clouds, chances are its pilot won't see you in time. Here is what the legal "business on top" leaves you very little leeway — particularly in jet territory.



TAKE 8 — Although checking lights before night flights is good, many pilots fail to take the 8 seconds necessary to check their tail lights. Breaking long old friends is fine, but not while flying. So take 8 — and stay alive.



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petroleum time-labor contractor; a Nationwide airplane fleet available on call.

- Full coordination by central dispatch service.
- All planes in the fleet available to all customers.

- Major cost reduction due to increased aircraft hours per plane, less broken time; reduction in deadheading, paid out by various companies to increase seat occupancy, standardization of equipment, and volume operations.

Kreiss breaks down the yearly fixed cost of a privately owned plane that may 2,000 entries, 6.5% depreciation, 2% insurance, 2% operations and dispatching, 1% hangar and 4.5% pilot's salary, to a total of 15.5% of the cost of the airplane.

Time Charges

On the other hand, out to the Private Air Travel customers is 4.5% of the total cost of the plane, since the company pays all the above fixed charges. In present, Kreiss said, a contractor would pay about \$90 per hour for a Cessna 190, based on a \$300 to yearly utilization rate.

A separate contract works this way: the company signs up for a specific make and model of airplane, tailored to his needs, a number of several flight hours, preparation of a part of the fuel consumption, maintenance and what would prevent exceeding fixed charges and hourly usage.

Integrating both of this arrangement is the prepayment payment, which Kreiss refers to as a "baudit deposit," less than the annual interest rate on cost of an airplane." The money comes to Private Air Travel as revenue, and will be used in financing of aircraft purchase, thus alleviating the need for the company to go outside for capital.

Kreiss and the prepayment agent meet initially



Hiller Unveils 12E Executive Version

Three-bladed Hiller 12E helicopters, flown by test pilot Bruce Jones, recently one of two intrepid men to fly a 112-ft. nonstop to Stanford University's Radiation Laboratory. Test flights on former damaged autogyro rule place after they were lowered by the 12E. Autogiro will be used to remove signals beamed off the atmosphere from a station 1,000 m. away. Below is the new Hiller 12E executive helicopter, a four-blade version of the 12E, powered by a 300-hp Lycoming engine. Stanley Hiller and first delivery will be made this fall. Owners of 12E can obtain a kit to modify the aircraft to executive configuration. \$12 production price is \$69,900.

- Leases that make no or contacting with a financially sound company, able to expand its logistic fleet as rapidly as customer commitments are received.
- The purchase payment is a constant "rental" item and not a capital investment.
- Purchase money can be recovered after a year on a pro rata basis, com-

pared to pay monthly costs or, in the first year, applied to contract renewals, or reduced in cash, all at the customer's option.

Category materials that require financing from the supplier would require a substantial return on investment, with resultant marketed stock or equity return to expand the firm. Kourna refers to the pre-purchase agreement as "a modest

amount of pump priming," in which the customer receives a major return of capital funds through time and money savings, and concentrated air travel service.

To stimulate national interest, Private Air Travel is offering dealers and distributors opportunities to expand their incomes beyond overall sales commissions alone. The program involves no distributor or dealer equity in the company, and no prime responsibility for operation.

Distributor Status

They will gain, according to Kourna, these advantages:

- Commissions on airplanes purchased by Private Air Travel to fulfill contracts originated with customers in the dealer's territory.
- Fees for aircraft servicing and long-hauling as arranged with Private Air Travel.

• Thirty per cent of the gross worldwide income realized from Private Air Travel customers who have contracted for that dealer's or distributor's share of airplane in his territory. This should result, Kourna feels, in a significant arrangement between distributor and Private Air Travel firms, for mutual benefit.

- Expansion of the dealer's overall business, including aircraft sales, leasing, charter, rental, service, storage and flight instruction, due to an expansion of flying by Private Air Travel's program.

Kourna emphasized that the Private Air Travel system is also competing with dealer airlines, and, in fact, cannot increase average passenger miles cost on a fixed rate basis, due to flight times, against U.S. costs for Private Air Travel planes.

Departing under the grant, he also stressed that the load factor will remain high and trip costs thus shared.

At present, Private Air Travel can plan about 30 planes who now are in the field calling on customers to sell the plane and gain firm commitments. Eventually, Kourna said, Private Air Travel will have up to 150 planes.

Lightweight Spray System Developed for Bell 47Gs

Aerospace Aviation Engineering Co., San Jose, Calif., has developed a new lightweight spray system for Bell 47G-3 helicopters. System consists of a spray boom installed aft and below the cabin that can dispense a field of 120 gal and are made of fiber-glass-reinforced epoxy resin boom incorporates a "Coop-Lite" spray control valve with a built-in separator section in the boom port which creates an immediate negative pressure on that side, cutting the spray flow at the end of each nozzle.

Aircraft, Parts Exports

April 1960

Item	April 1960		Cumulative totals January-April 1960	
	Number	Value (\$1,000)	Number	Value (\$1,000)
Aircraft, parts, and accessories, total		103,210		400,722
Commercial and civilian aircraft, total	340	94,419	710	190,246
Aircraft, 2,000 lb. and over empty airplane weight				
Cargo transports, commercial, new				
Passenger transports, commercial, new:				
0,000-4,999 lb. empty airplane weight	8	712	16	8,046
10,000-20,000 lb. empty airplane weight	1	102		
20,000 lb. and over empty airplane weight	9	45,415	16	115,947
Fuselage wing struts, commercial, new	1	360	9	940
Commercial and civilian aircraft, total	15	4,031	46	7,081
Aircraft, under 2,000 lb. empty airplane weight				
Utility, commercial and civilian, new:				
4 places and under	12	242	17	403
4 places and over	110	1,704	246	4,799
Cargo wing, commercial, new	11	767	32	1,524
Commercial and civilian aircraft, used and rebuilt, including converted	42	508	104	176
Commercial and civilian aircraft, new, less than empty airplane weight				
Aircraft engines, reciprocating, new, air-cooled, over 400 hp	102	408	604	1,136
Aircraft engines, reciprocating, used and rebuilt	143	1,023	602	3,028
Aircraft components, parts, and accessories, used		77,289		230,482

SOURCE: Foreign Trade Division, Bureau of the Census.

*All-weather reciprocating engine, over 400 hp, and over are limited to "aircraft components, parts, and accessories."

**Includes military aircraft.



FIRST PROTOTYPE Utva 56, Yugoslav multi-purpose airplane. Shown off the grass strip at Velenje Airport in begin impressive demonstration. Note stowed convertible undercarriage and controllability at lowspeed out of its wide performance range.

Yugoslavian STOL Utva 56 in Production

By David A. Anderson

Venice—First Western appearance of the multi-purpose Yugoslav Utva 56 at the Eighth International Aerospace and Display here heralded its entry as a competitor with U.S. and European aircraft in the STOL market.

Comparable in dimension, layout and performance to such designs as the German Dornier Do 27, Czech Biaggio D-3, U.S. Helio Courier, the Yugoslav plane impressed technical observers with its outstanding flight performance and excellent maneuverability.

The aircraft demonstrated at Venice's St. Nicolaus Airport was flown by Dr. Petar Mihalek and was the first prototype. Design of the Utva 56 was done by Borivoj Nikolic and Dragoljub Pericic, both engineers of the Fakultet Aviona Utva at Pančevo, Yugoslavia.

Utva 56 Specifications

Wing area, ft. ²	35.4
Overall length, ft.	37.7
Overall height, ft.	8.5
Wing span, sq. ft.	192.8
Taref weight, lb.	2,686
Maximum speed, mph.	193
Stalling speed, mph.	49.7
Cooling speed, mph.	112.140
Rate of climb, ft./min.	1,190
Takeoff distance, ft.	615 ^a
Landing distance, ft.	1,125 ^b
Still air range, mi.	372
Service ceiling, ft.	16,480

^a Over 10 ft. (15 second) obstacle.



THREE-VIEW drawing of Utva 56 shows conventional layout and effectively placing configuration. Gliders at the display were impressed by the high quality of workmanship shown in this first prototype and the attention paid by its designers and constructors to details. Wingspan is 32.6 ft., overall length is 27.2 ft. and overall height 8.5 ft.



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barrier. Engines start on their own power. You are completely independent of airport ground crews and ground-handling equipment. This time-saving is also part of true speed. Add to that the Gulfstream's exceptional rate of climb. And a striking speed of 560 mph at 25,000 feet . . . and even higher altitudes, in pressurized comfort. In other words, the Gulfstream delivers optimum door-to-door performance.

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CLEAN LINES of Utva 55 show to advantage in this high-speed air race showing at the Eighth International Aeromotored Display organized at Vnecer's St. Nino's Airport.



REAR PORTION of upper fuselage wing wings spread to give room to large cabin of Troposki Utva 55. Multi-purpose plane can handle passengers like by carrying cabin seats as well as open-faced, sport or light transport work.

dog and can still be operated differently for lateral control.

Otherwise the airplane is a proven multi-angled layout, resembling its contemporaries in the STOL field. Although planned performance figures given in the company's catalog call for takeoff and landing distances of, for example, the landing distance over a 40 ft. (12.5 m.) obstacle in under 1,300 ft.—in the hands of a pilot familiar with the airplane's takeoff and landing performance per se, it speaks for itself.

Large cabin of the Utva 55 seats four persons, and can be converted to carry freight or medical cases by removing the seats. There are two passenger doors, one on each side of

the cabin in the conventional location, and a third nose door, which is formed by the round nose portion of the canopy aft of the wing spar. Optional installations include oxygen equipment.

Standard instrumentation, including instrument panel and navigation aids, is fitted. The aircraft has landing light and a search light for night flying.

Designers say that one engine up to a maximum rating of 260 hp can be installed. The Utva 55 also can be fitted with optional wheels, floats or skis.

Gross load in part over 1,000 lb. Fuel tanks hold 42 gal. and there is normal baggage allowance and space for 50 lb.



BELL UH-1A helicopters assigned to Army medical units operate on wet ground near a field hospital in Chile.

Bell Helicopters Aid Chileans in Disaster

Ability of Bell UH-1A Iroquois helicopter and its友型的 UH-1N twin-engine helicopter to operate successfully under adverse weather and maintenance conditions was exhibited during Operation Arana, when the U.S. sent two Army ambulance medical detachments to earthquake-torn Chile to assist in disaster relief.

Aircrews mention reflecting the unusual down burst winds have only rarely been visible. The first UH-1As of the 57th Medical Detachment (Helicopter Ambulance) attached to the Army's 15th Field Hospital, Ft. Bragg, N.C., were heavily engaged in rescue work after a twin UH-1A cast from the 57th Medical Detachment (Helicopter Ambulance), Ft. Meade, Md., was assigned emergency status including supporting communications crews trying to strengthen a day before it could break. The isolated flying drama of direct fuel had to supply balloonists and other equipment.

Marginal Weather

The 57th for Bell flew 100 miles in approximately two weeks for a total of 182.25 hr., carrying agents, nearly 400 passengers and 77,320 lb. of cargo. The missions were complicated during marginal weather approximately 90% of the time.

Illustrating flying conditions was one mission flown by Lt. Norman T. Elliott, assigned to airfield food, clothing and medicine to an isolated area, surrounded by mountains and located on a lake, from which no communication was being received—the helicopter had been unable to land.

In attempting to land, Lt. Elliott and his Chilean air force observer encountered strong gusty winds. After

takoff, wind conditions became severe, so one from the pilot looked at his altitude indicator and saw 11,000 ft. above the top of a mountain. After passing the peak he continued climbing to 10,500 ft.; then made a long final toward the base here.

Three helicopters assigned to the

U. S. Business & Utility Aircraft Shipments

May 1968

Manufacture and Model	No. of Units	Net Weight
Army: CH-47 Chinook	1	\$100,000
CH-47E	1	
Boeing CH-47 Chinook	1	\$100,000
CH-47D	1	
CH-47C	1	
CH-47B	1	
CH-47A	1	
CH-47F	1	
CH-47G	1	
CH-47H	1	
CH-47I	1	
CH-47J	1	
CH-47K	1	
CH-47L	1	
CH-47M	1	
CH-47N	1	
CH-47O	1	
CH-47P	1	
CH-47Q	1	
CH-47R	1	
CH-47S	1	
CH-47T	1	
CH-47U	1	
CH-47V	1	
CH-47W	1	
CH-47X	1	
CH-47Y	1	
CH-47Z	1	
CH-47AA	1	
CH-47BB	1	
CH-47CC	1	
CH-47DD	1	
CH-47EE	1	
CH-47FF	1	
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CH-47OO	1	
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CH-47QQ	1	
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of 110 to the disengagement were lost. After the completion of the tests, which all four engines were running, maximum levels of handling rates were determined. These included a high speed dive lasting about 3 minutes, followed by several rolls carried out in various configurations. During the trials it was also ascertained that the first roll at a constant rate reached 33 deg per the captain's log.

Roll Checks

Rate of roll checks which followed were conducted during a 580 ft per second and 100 ft per second pitch rate. The reported roll rate was considered to be acceptable. When these checks had been finished the captain advised Engine Officer Boulter & these were very similar tests which could be done before descending to make fuelled trials. The engine officer then again guided the aircraft through the day's trials. Following these tests and the completion of the first roll, the aircraft was to be tested by RACAE Flight Operations Department on May 12, 1986, the previous part of which was:

Checking and Descending. During checks and descents the captain and the engine officer are cross-check their altimeters at 20,000 ft and 10,000 ft. This is to avoid the possibility of misreading the altimeter by up to 3000 ft. The aircraft will descend to 10,000 ft as early as possible, in fact, at 15,000 ft unless there is a problem.

In 1978 there occurred an accident resulting from the misreading of an altimeter.

The aircraft involved, a Vickers Viscount, was en route from London to the West Indies.

With the aircraft flying at 10,000 ft just above a cloud layer, we will come over the top of this and have difficulty there if you please.

A course was chosen for about 15 miles and during the descent the engine officer between they were about 100 ft apart.

The southern leg of the Hong Kong flight was unanticipated and followed to the Hong Kong airport.

At the time of the accident, the flight crew reported that they were expected to land at 10,000 ft as the first officer implied.

With the aircraft flying at 10,000 ft, the engine officer took action to descend the aircraft.

1) Misreading the altimeter.

2) Misreading the altimeter in conjunction with the disengagement of a +10,000 ft reading error.

3) Disengaging an instrument.

4) Disengaging an instrument more rapidly than current operational norms.

On Feb 16, 1986, following an investigation into the cause of the accident, the Air Force Board of Inquiry recommended that Britainair, Comet and Vickers aircraft must be equipped with improved altimeters having a resolution where probability of a 10,000 ft reading error is removed.

CAI Circular

On Feb 25, 1986, the following Civil Aviation Information Circular was issued:

Flight Safety Warning

Regarding the 3 Pounder Sensitive Altimeter:

It is known that with the existing instrument, if the instrument is jolted or jarred, errors of up to 10,000 ft can be introduced.

2. Errors in sensitive reading are most likely to be made when suddenly changing altitude. The instrument panel has been interrogated and it is known that the sensitivity of the flight deck instruments is increased when changing climb or descent. The instrument panel, when mounting the instruments, is mounted, may be very different from that anticipated. In these circumstances the maximum error of the instrument is not known, but the ability of determining a position out of visual contact cannot be guaranteed.

The aircraft under test, during a roll, the first officer reported, on passing through 45°, to see a second level below, failed to be able to identify the second level. An attempt to check the aircraft's descent was too late as he passed it striking the ground. The aircraft banks up progressively and rolled into the ground.

The aircraft banks up progressively and rolled into the ground. None of the crew

was killed. The time of impact was about 100 ft and the position of the crash was within the area of controlled airspace, near Hong Kong.

The three parties involved were a legal development of the importance to make the requirements of flight at higher altitude operational. On the year of the accident 90% of the world was covered by the field of altitude protection, was carried out both in the United Kingdom and abroad.

In 1971, as a result of Council Regulation concerning over a wide range of aircraft, the European Commission set up a committee which will work on bringing aircraft with which all flights on British aircraft were reigned at the time of the subject as follows:

This altimeter had a 10,000 ft

pointer which extended to the outside scale and could therefore easily be confused with the inside scale.

However, in a report on the accident involving the disengagement of an altimeter during flight, an order was issued by RACAE Flight Operations Department on May 12, 1986, the previous part of which was:

Checking and Descending. During checks and descents the captain and the engine officer are cross-check their altimeters at 20,000 ft and 10,000 ft. This is to avoid the possibility of misreading the altimeter by up to 3000 ft. The aircraft will descend to 10,000 ft as early as possible, in fact, at 15,000 ft unless there is a problem.

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A course was chosen for about 15 miles and during the descent the engine officer between they were about 100 ft apart.

The southern leg of the Hong Kong flight was unanticipated and followed to the Hong Kong airport.

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With the aircraft flying at 10,000 ft, the engine officer took action to descend the aircraft.

1) Misreading the altimeter.

2) Misreading the altimeter in conjunction with the disengagement of a +10,000 ft reading error.

3) Disengaging an instrument which operates in the

range of altitudes where reference to the 10,000 ft pointer as the reference is still maintained for the need for care in reading this type of altimeter, particularly.

(2) Failure to string any stage of the aircraft.

(3) An issue, which consisting of the right engine, has been, at a long, interrupted.

On Feb. 26, 1986, the United Kingdom Airline Committee set up a committee to investigate the cause of the accident. The committee found that the type of altimeter found in the aircraft system of the first officer's instruments block a pointer link would however have an effect on the captain's altimeter. Calculations showed that the effect on the first officer's altimeter would be small, less than 100 ft, but less than 30,000 ft it was decreasing with distance.

They also show that if an alternative calibration of 10,000 ft is not high enough than the aircraft will be unable to fly at 10,000 ft. Flying at an altitude of 10,000 ft there an associated required altitude would require a speed of 665 ft when flying at 200 ft "IAS".

Wreckage Inspection

An inspection of the wreckage established that the engine and undercarriage were assembled and that the first drop damage clearly was the extended gear. The engine was found to be operating at the time of impact. A complete list of test reports compiled during the investigation were reviewed. From the wreckage and the provided details of investigations and the engine log, damage during the accident is shown. Damage to the engine was caused by the engine failing in every way possible except in the engine's engine.

The prop and static pressure pipelines of the other instruments were severed and the propeller was broken. The propeller and static pressure pipelines attached to each panel revealed a linkage as the static loss of the engine's panel established that this was due to mode damage incurred by the end of climb or descent.

Subsequent examination and test of the first officer's instrument panel revealed a slight link from the disengaging unit of the altimeter to the indicator.

The unit was found to be intact and was locked. During the test of the instrument panel, the indicator appeared on the panel could effectively read the link and it is possible, therefore, that the linkage was not detected during the previous inspection and pressure checks due to the lack of a visual inspection.

In the conclusion of the test and records relating to the instrument shows that the instrument was unengaged for sufficient time and was then refitted. It has not been possible to determine the precise sequence of events, but it is possible that the disengagement of the indicator was not significant.

2. Errors in sensitive reading are most likely to be made when suddenly changing altitude. The instrument panel has been interrogated and it is known that the sensitivity of the flight deck instruments is increased when changing climb or descent. The instrument panel, when mounting the instruments, is mounted, may be very different from that anticipated.

In these circumstances the maximum error of the instrument is not known, but the ability of determining a position out of visual contact cannot be guaranteed.

The aircraft under test, during a roll, the first officer reported, on passing through 45°, to see a second level below, failed to be able to identify the second level.

An attempt to check the aircraft's descent was too late as he passed it striking the ground.

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were killed. The time of impact was about 100 ft and the position of the crash was within the area of controlled airspace, near Hong Kong.

The three parties involved were a legal development of the importance to make the requirements of flight at higher altitude operational. On the year of the accident 90% of the world was covered by the field of altitude protection was carried out both in the United Kingdom and abroad.

The disengagement between the engine of the aircraft and the first officer's instrument panel which will result in damage to the aircraft and undercarriage. The type of altimeter found in the aircraft system of the first officer's instruments block a pointer link would however have an effect on the captain's altimeter. Calculations showed that the effect on the first officer's altimeter would be small, less than 100 ft, but less than 30,000 ft it was decreasing with distance.

They also show that if an alternative calibration of 10,000 ft is not high enough than the aircraft will be unable to fly at 10,000 ft. Flying at an altitude of 10,000 ft there an associated required altitude would require a speed of 665 ft when flying at 200 ft "IAS".

Comparisons of the outside air temperature recorded during the climb with the upper air temperature provided by the Meteorological Office confirm that as of made at approximately 10,000 ft it was stable.

At 10,000 ft, the first officer reported to Air Traffic Control that the height of the aircraft was 10,000 ft. At and at 11,513 ft, according to the aircraft's altimeter, the aircraft was 12,000 ft, or a difference of 1,000 ft in 15 m.

Reviewing these times, according to the first officer, the aircraft was recorded. The aircraft was approximately 3,000 ft above a cloud layer. From a consideration of the meteorological conditions, however, it would seem that the end cloud layer which existed in the vicinity of Hong Kong was at 10,000 ft.

The flight duration was considered unsafe after 10,000 ft with the external engine at "Right" 1. The power and at an altitude of about 100 ft. The climb rates were in the normal range. Under these conditions the aircraft would have been able to fly at 10,000 ft.

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Sud Aviation Frelon Completes Company Tests

Sud Aviation's triple-boom Frelon helicopter has completed safety postures of company tests and is being moved over to the French government for further testing. (NW) 15, 1977, p. 36. Frelon registered maximum speed of 121 kt, cruise at 114 kt and flew at altitudes up to 13,121 ft. (C) 1986 Comité des avions de transport

b) The captain assumed or failed to read the indicated altitude of the aircraft during the concluding stage of the flight.

6. The first officer assumed his altitude by comparing the aircraft's own height when reporting the aircraft's altitude to Air Traffic Control at 10,000 and 11,513 ft.

Opinion

Comparisons of the outside air temperature recorded during the climb with the upper air temperature provided by the Meteorological Office confirm that as of made at approximately 10,000 ft it was stable.

The height presentation allowed by the type of three-pointer altimeter fitted to the subject aircraft was such that a higher degree of altimeter was required to interpret correctly the aircraft's altitude during the climb.

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it of the facilities that would be available. In that respect, as a result of meeting task place on Oct 14, 1979, between the task force and the national authority responsible for the maintenance of the aircraft, the Air Force Board of Inquiry recommended that the aircraft be returned to the Air Force Board of Inquiry for removal.

On Sept. 11, 1980, the aircraft was returned to the Air Force Board of Inquiry.

On Sept. 21, 1980, a letter was sent to Mr. Myers giving notice that some degree of responsibility for the accident might be attributed to him. The letter offered Mr. Myers the opportunity to respond to the letter before it was submitted to the Board of Inquiry.

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Compliance With Regulations

1. Considering this investigation the provisions of Regulations Title III of the Civil Aviation Investigations and Accidents Regulation 1974—Statutory Instrument 1974/1671—should be complied with the following section being born rule:

Chief constable has been given the representations made on behalf of the late Capt. J. E. Jackson and by Mr. G. C. L. Jackson, his son, and the representations of the late Capt. T. E. Jackson, his son, giving notice that some degree of responsibility for the accident might be attributed to Capt. Jackson. The chief constable has an opportunity of examining the rights under Regulation 7(1) and submitted



The U.S. Air Force's
Atlas, produced by
Convair-Astronautics,
is the free world's
first ICBM and is now
operational with the U.S.A.F.
Strategic Air Command.

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